WORKING PAPER

ITLS-WP-14-04

Understanding the relationship between voting preferences for public transport and perceptions and preferences for bus rapid transit versus light rail

By
David A. Hensher, Corinne Mulley and
John M. Rose

March 2014

ISSN 1832-570X

INSTITUTE of TRANSPORT and LOGISTICS STUDIES

The Australian Key Centre in
Transport and Logistics Management

The University of Sydney

Established under the Australian Research Council's Key Centre Program.

NUMBER: Working Paper ITLS-WP-14-04

TITLE: **Understanding the relationship between voting preferences for public transport and perceptions and preferences for bus rapid transit versus light rail**

ABSTRACT: Despite the plea for a rational debate on the role of alternative public transport modes, there is often great resistance to some options on essentially ideological and emotional grounds. The aim of this paper is to understand the key perceived barriers that mitigate against support for BRT in the presence of LRT options, and the way in which these differ between users and non users of public transport. We develop best-worst preference experiments, one associated with design characteristics, and the other with service descriptions associated with BRT and LRT, and an experiment that focuses on voting preferences. The main focus of this paper is establishing a mapping between the voting preference evidence and the relative support for bus (BRT) and LRT. A survey of residents of six capital cities in Australia provides the empirical context.

KEY WORDS: ***Bus rapid transit, light rail transit, perceptions, buy in, voting preferences, service attributes, design attributes***

AUTHORS: **Hensher, Mulley and Rose**

Acknowledgements: This paper is a contribution to the research program of the Volvo Research and Education Foundation Bus Rapid Transit Centre of Excellence. We acknowledge the Foundation for funding support and discussions with Juan Carlos Muñoz, Jun de Dios Ortuzar and Patricia Galilea as part of our ongoing collaborative research program. We are especially thankful to Jun Zhang for his contribution in programming the survey instrument. Authors contributed equally and are placed alphabetically.

CONTACT: INSTITUTE OF TRANSPORT AND LOGISTICS STUDIES (C13)

The Australian Key Centre in Transport and Logistics Management

The University of Sydney NSW 2006 Australia

Telephone: +612 9114 1824

E-mail: business.itlsinfo@sydney.edu.au

Internet: http://sydney.edu.au/business/itls

DATE: March 2014

1. Introduction

Public Transport (PT) modes serve many roles in cities throughout the world. We see different elements of PT in each city; some having the full complement of bus in mixed traffic, bus in dedicated road environments, light rail in mixed traffic or a dedicated corridor, and heavy rail. The most toxic of the debates has been on the potential role of bus rapid transit (BRT) in comparison with light rail transit (LRT) and heavy rail. Despite the arguments promoting the advantages of BRT, there is resistance to BRT as an alternative to a rail solution.

The aim of this paper is to understand, from the wider population of stakeholders, the nature of barriers that mitigate against support for BRT in the presence of LRT options. The approach developed to understand perceptions and biases involves two stages; the first is a best-worst preference experiment in which a number of statements about public transport in a generic sense, as well as with reference to specific modes (BRT, LRT), are presented in sets of four, and respondents are asked to indicate which one they perceive as the best circumstance and which one they perceive as the worst. The sets of statements are varied across preference sets to elicit the role of each statement (up to a probability) as an identified barrier against or in support of public transport seen in general or in the context of a specific mode. This exercise provides a way of narrowing down the substantive factors that influence (by degree) an individual's perception of BRT and LRT in particular and public transport in general, and the ways in which this varies between users and non users of public transport.

The main focus of this paper is establishing a mapping between the voting preference evidence and the relative support for bus (BRT) and LRT, as a way of establishing evidence to support a specific marketing strategy designed to reduce the barriers that mitigate against BRT in the presence of LRT and to understand how this may need to differentiate between users and non users of public transport. A survey of residents of six capital cities in Australia provides the empirical context.

The paper is organised as follows. We begin with a review of the broader literature identifying stakeholder views on the appeal (or otherwise) of LRT and BRT, and identify factors associated with design of a PT system, and those associated with service delivery. In addition, we recognise the need to establish the dimensions of PT that are not explicitly associated with a particular mode that matter to stakeholders and which would be positive elements if stakeholders were to vote on PT priorities. We then discuss the attributes selected for this study, the sampling process, data collection, the best worse approach and model estimation. We report findings for the entire sample of six Australian cities, where exposure to BRT and LRT varies, distinguishing between users and non users of PT. The concluding section summarises the main findings and points to the way in which the analysis of this paper can be used in a subsequent choice experiment to seek out the levels of service, design and other influences that can offer a way forward in obtaining support for BRT over LRT in the future.

2. Identifying key characteristics of BRT and LRT influencing preferences

On a number of reasonable assumptions, the patronage potential for a bus-based transitway can be as high as twice that of LRT (David Wohlwill)[1] and Sislak, K.G. 2000). The relativities will be determined by the sophistication of the design of the bus-based system. Establishing actual patronage is another issue, although we have yet to find any unambiguous real evidence to suggest that you can attract more people to LRT than a bus-based scheme. This arises because of *the difficulty of finding very similar circumstances in which both LRT and a geographically comparable bus-based system are in place*. Certainly the performance of the growing number of dedicated bus-based transitway systems in many

[1] http://131.247.19.10/media/presents/trb-04/wohlwill.pdf , accessed 30 July 2013

locations such as Curitiba, Bogota (Estache and Gomez-Lobo 2005), Brisbane, Pittsburgh and Ottawa deserve closer scrutiny.

Hass-Klau and Crampton (2002) suggests that '[The]…high cost and inflexibility of light rail – often considered to be drawbacks – actually turn out to be its main advantages'. They argue that inflexibility is actually 'code' for security – the population is confident that a change of political power or financial situation will not result in the new system being taken away from them, and can therefore plan their lives knowing that the system will be there in the future. This also seems to be the basis of light rail investments adding more to land values than bus based systems although permanence of light rail systems do not have a good historical record with many (or most) tram systems having been removed and replaced by more flexible buses in the past. Hass-Klau and Crampton also state that "…the infrastructure costs are closer together than has often been assumed". They quote busways at £526,000 per kilometre and light rail (and guided busways) at £561,000 to £702,000 per kilometre. However, the evidence is far from clear, with the Rapid Transit Monitor published by TAS in the UK identifying 30 projects for light rail and tramway schemes in the UK (including extensions to existing systems) to be struggling financially. A salient lesson from the ongoing debate on technology preference (or is it bias /ideology?) is that one should distance thinking from an obsession with technology and move to study the needs as a starting point of inquiry. Do not ask if a particular technology is feasible, but ask who the users are, and proceed to investigate how they may best be served. Let technology assist and not lead.

The Canadian Urban Transit Association (2004) identified a number of major benefits of BRT, which have repeatedly been reported in many other jurisdictions:

Service speed and reliability. With average operating speeds of 45 to 50 km/h and consistent travel times, BRT services on busways and bus lanes are more attractive than conventional transit routes operating at half that speed and with lesser reliability due to congestion.

Greater patronage. BRT projects build patronage because they offer a premium service with faster speeds and greater reliability. The use of special branding to promote BRT services also helps attract new users.

Lower costs. The faster average speeds of BRT reduce operating costs. BRT facilities cost less to build than LRT because they do not need specialised electrical, track, vehicle maintenance or storage infrastructure.

High capacity. High-capacity vehicles, frequent service and flexible routing structures allow BRT to match or exceed the passenger volumes of the busiest LRT systems.

Operational flexibility. BRT allows a variety of customer services, with a single running way able to support express, local and skip-stop services—a difficult and expensive proposition in a rail environment.

Incremental implementation. BRT systems can be implemented in stages. Buses can use a BRT facility to travel through a congested area, then switch onto a roadway to serve a relatively uncongested corridor.

Land use change. BRT can stimulate the development or redevelopment of compact, pedestrian- and transit-friendly land uses, when supported by complementary land use and zoning policies. This contradicts the claims by proponents of LRT that only rail-based investments can deliver such development stimulus because it is 'permanent'.

This report is representative of studies in what has become a large literature base. Drawing on the contributions of Hensher 1991, Swanson *et al.* 1997, Cirillo et al (2011), dell'Olio et al. (2010a,b), Eboli and Mazzulla (2010, 2008a,b), and Marcucci and Gatta (2007), a framework was developed in which candidate attributes were identified. These sources were complemented by a number of grey literature reports or 'best practice' guidelines with a strong strategic and tactical focus.

These combined to give a range of operational attributes, called statements, relating to key practices and public policies favourable to public transport, and which could be used to differentiate between rail and bus based modes. The selected set of statements associated with public transport design and service in the context of buses (including BRT) and LRT are presented in Table 1 together with the statements which are related to stakeholder support in a voting context. This Table presents the statements favouring Bus (BRT); however for the design and service attribute experiments we have also reversed every statement (favouring LRT – available from the author), doubling the number of statements built into the design of the best-worst preference experiments.

Table 1: The sets of statements related to public transport design, public transport service levels and public transport voting preferences

	Public Transport Voting Preferences	Public Transport Service Levels	Public Transport Design
1	Systems with comfortable vehicles	Travelling by bus is safer than travelling by light rail (tram)	There are less light rail (tram) stops than bus stations so people have to walk further to catch light rail
2	Smart vehicles	Bus travel times in a bus lane or dedicated corridor are faster than light rail (tram)	Bus systems provide better network coverage than light rail (tram) systems
3	Quick journey times	Crowded buses are less horrible to travel in than crowded light rail (trams)	A new bus route in a bus lane or dedicated corridor can bring more life to the city than a new light rail (tram) line
4	Some corridors with good service levels, even if other corridors had less good service levels	Buses in a bus lane or dedicated corridor are more reliable than light rail (trams)	A bus service in a bus lane or dedicated corridor looks faster than a light rail (tram) service
5	New rail links, even if these are shorter than a package of investments with good bus-based services	Buses look cleaner than light rail (trams)	Bus routes are fixed, so bus stops provide more opportunity for new housing than a light rail (tram) line which can be changed very easily
6	Value for money for the taxpayer	Buses are cleaner than light rail (trams)	New bus stops or a new bus route in a bus lane or dedicated corridor will improve surrounding properties more than new light rail (tram) stops
7	The greatest length of high quality corridors, irrespective of whether train, tram or bus	A bus journey in a bus lane or dedicated corridor is more comfortable for passengers than a light rail (tram) journey	Buses in a bus lane or dedicated corridor are more environmentally friendly than light rail (trams)
8	A network that is cost effective to operate	Buses are more modern looking than light rail (trams) and hence have more appeal in urban settings	More jobs will be created surrounding a bus route in a bus lane or dedicated corridor than a light rail (tram) route

9	Low fares	Bus journeys require less transfers than light rail (tram) journeys	A bus service in a bus lane or dedicated corridor is more likely than a light rail (tram) to still be in use in 30 years time
10	Higher fares to pay for higher quality services	Buses have cleaner seats than light rail (trams)	Bus services stop nearer to more people than light rail (trams) services
11	Frequent services	Buses are cleaner on the outside than light rail (trams)	Bus services are less polluting than light rail (trams)
12	Fast overall journey time to destination, including getting to and from the station or stop	Bus stops are cleaner than light rail (tram) stops	Bus services are more likely to have level boarding (no steps up or down to get on the vehicle) than light rail (trams)
13	A network with few interchanges	Bus services in a bus lane or dedicated corridor are more frequent than light rail (tram) services	Buses are quieter than light rail (trams)
14	Interchanges between services and modes (bus, train, ferry) if this makes overall journey times quicker	Bus stops are safer than light rail (tram) stops	Bus services in a bus lane or dedicated corridor services have been more successful for cities than light rail (trams)
15	The package that is quickest to implement	Bus services in a bus lane or dedicated corridor do not get delayed like light rail (tram) services	Buses in a bus lane or dedicated corridor are more permanent than light rail (trams)
16	Slow implementation is not a problem if the package delivers the right public transport system	Buses provide a better comfort level than light rail (tram) services	Buses in a bus lane or dedicated corridor provide more opportunities for land redevelopment than light rail (trams)
17	High quality bus routes on dedicated roads (so that they do not suffer from delays from cars)	Buses provide easier boarding than light rail (trams)	Buses in a bus lane or dedicated corridor provide more focussed development opportunities than light rail (trams)
18	Systems that give wide network coverage	Car drivers are more likely to transfer to bus services in a bus lane or dedicated corridor	Buses in a bus lane or dedicated corridor are more likely to be funded with private investment than

		than to light rail (tram) services	light rail (trams)
19	Packages which offer good safety for the passenger	Buses in a bus lane or dedicated corridor provide a better quality of service than light rail (trams)	Buses in a bus lane or dedicated corridor support higher population and employment growth than light rail (trams)
20	Packages which give an outcome that will last for many years	Buses provide better personal security for travellers than light rail (trams)	Building bus lane or a dedicated roads and buying buses makes a bus system cheaper than putting down rails and buying light rail (trams)
21	Bus based systems of public transport	Buses are sexy and light rail (trams) are boring	Bus services provided in a bus lane or dedicated corridor have lower operating costs than light rail (tram) systems
22	Easy to use fare system	A public transport network with bus rapid transit (BRT) will provide a greater network coverage than one with light rail (trams)	Bus services provided in a bus lane or dedicated corridor have lower operating costs per person carried than light rail (tram) systems
23	Investment package most likely to benefit your city		Building a new bus route in a bus lane or dedicated corridor will cause less disruption to roads in the area than a new light rail (tram) line
24	The package of investments most likely to benefit you		Overall, buses in a bus lane or dedicated corridor have lower maintenance costs than light rail (trams) and light rail (tram) track
25	The package of investments most likely to get car drivers out of their car and onto public transport		Bus stops have greater visibility for passengers than light rail (tram) stops
26	The package of investments least likely to increase taxes		Buses in a bus lane or dedicated corridor have lower accident rates than light rail (trams)
27	The package of investments giving the highest capacity for travellers		Buses in a bus lane or dedicated corridor provide a more liveable environment than light rail (trams)

28	The package of investments which allows the city to grow sustainably		Buses in a bus lane or dedicated corridor have greater long term sustainability than light rail (trams)
29	The package of investments which allows housing to be built around stations.		Buses provide more comfort for travellers than light rail (trams)
30			Bus systems are quicker to build and put in operation than light rail (tram) services in a light rail (tram) lane or dedicated corridor
31			The long term benefits of a new bus route in a bus lane or dedicated corridor are higher than a new light rail (tram) line
32			House prices will rise faster around new bus associated with a bus lane or dedicated corridor stops than light rail (tram) stops
33			Buses in a bus lane or dedicated corridor provide better value for money to taxpayers than light rail (trams)

3. Approach: the best worst preference experiment

The focus of the empirical inquiry is on identifying the drivers favouring LRT over BRT, which send a challenge signal as to whether there is scope to reverse this position by better communication of evidence. Perceptions can be re-conditioned with the appropriate information.

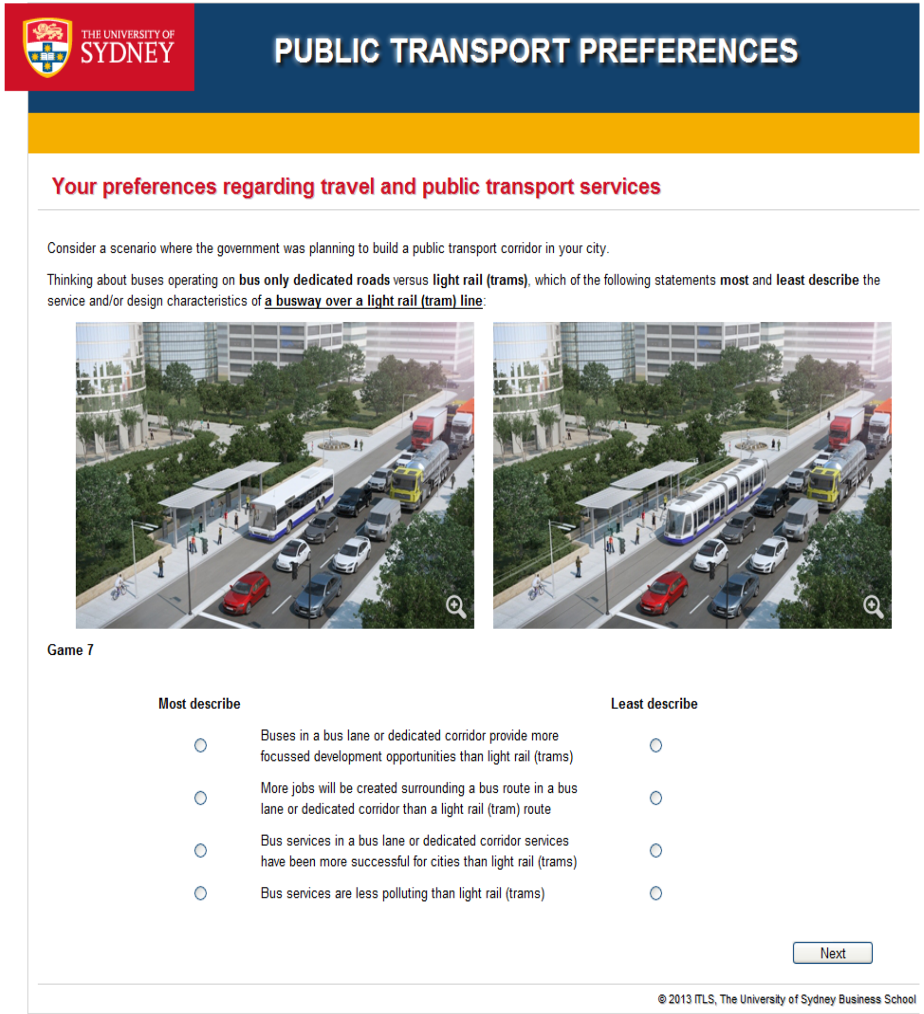
There are a number of different methods available to elicit preferences. Widely used direct-questioning methods, such as Likert scales, suffer from well-established drawbacks due to subjectivity (for a summary see Paulhus, 1991). Discrete choice methods such as those that involve choosing a single preferred option from a range of presented options - provide more reliable and valid measurement of preference. But in recent years there has been growing interest within the discrete choice framework on seeking responses to scenarios where stakeholders select both the best option and worst option (or attribute) from a set of alternatives, and this literature recognises the additional behavioural information in the best and worst response mechanism (e.g., Marley and Louviere 2005, Marley and Pihlens 2012). The best-worst scaling delivers more efficient and richer discrete-choice elicitation than other approaches, and is gaining popularity as a way to narrow done a set of attributes for a traditional choice experiment from a much larger set that are candidate influences on preferences. It is hence an attractive method for the preference assessment of the large number of statements in Tables 1 to 3, which far exceed the number that might be included in a comprehensive and comprehendable stated choice experiment.

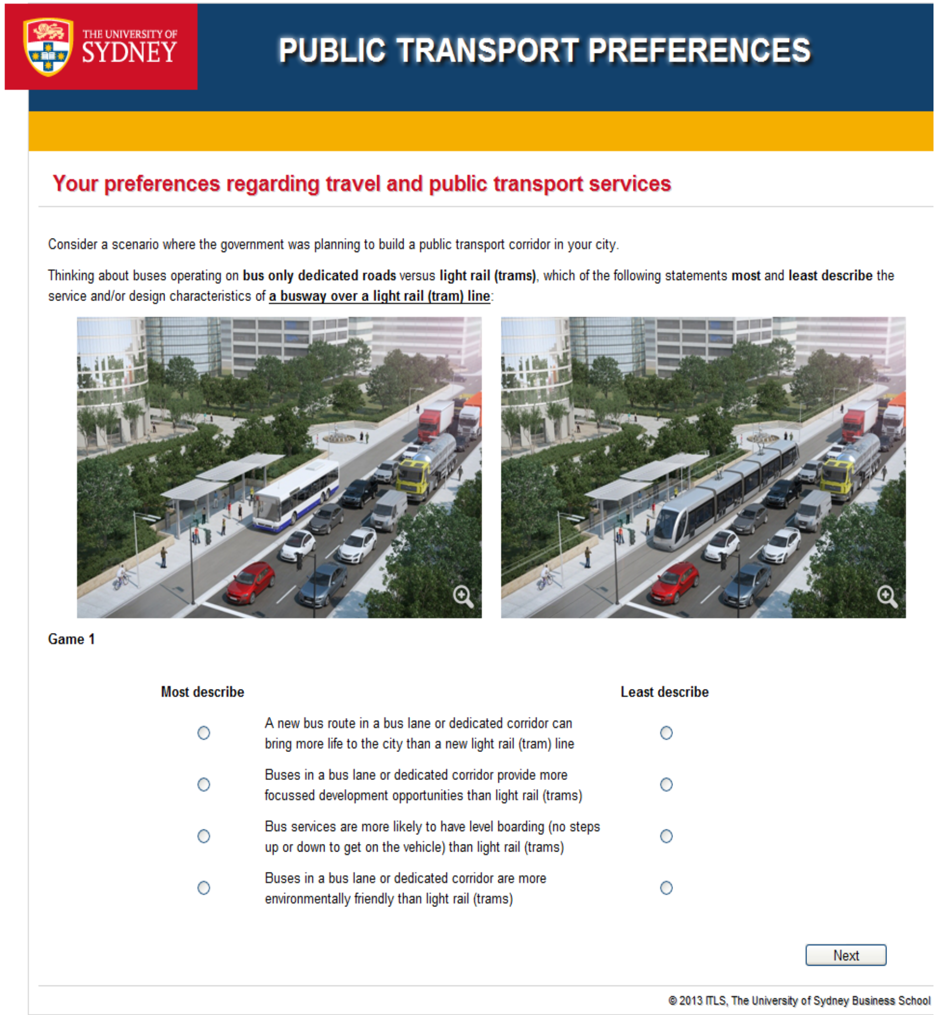
Recent advances in survey design for stated choice experiments suggest that obtaining a ranking from an iterative set of best-worst choices offers significant advantages in terms of cognitive effort (for example, see Auger et al. 2007; Cohen 2009; Flynn et al. 2007; Louviere and Islam 2008). In addition to the standard choice response (the most preferred option), we include a response mechanism to reveal the respondents perceived worst alternative. This method can be implemented at the attribute or statement level (as in the current study) or at a choice alternative level. As is common practice with best-worst choice data, the observation for the worst choice is assumed to be the negative of the best choice data. Under this assumption, preferences for the least preferred choice are assumed to be the negative inflection of preferences for the most preferred choice (see Marley and Louviere 2005, Marley and Pihlens 2012). Best-worst scaling as a data collection method has been increasingly used in studying consumer preference for goods or services (Collins and Rose 2011; Flynn et al. 2007; Louviere and Islam 2008; Marley and Pihlens 2012). Best-worst data is typically analysed using conditional logit models.

Different experimental designs were generated for each set of questions (i.e., design barriers, service barriers and voting influences). All three designs were Bayesian D-efficient designs assuming normally distributed priors, with means of zero and standard deviations of one. The designs allowed for all main effects and were constructed to allow for best-worst choices. In generating the designs, it was assumed that the alternative chosen as best was deleted when constructing the pseudo worst choice task. To generate the design, spherical-radial transformed draws were used (see Gotwalt et al. 2009) assuming three radii and two randomly rotated orthogonal matrices. The final designs had 22, 34 and 15 choice tasks for the design barriers, service barriers and voting influences experiments respectively.

Illustrative preference screens are given in Figures 1-2 for each the experiments with pictures. A similar screen was shown to respondents for their voting preferences, without pictures. These pictures used specially designed images of BRT and LRT with different vehicles shown against a common background. A separate screen assigned these as part of the design of the preference experiment with respondents being asked to identify their preferences for each image [2].

[2] The underlying experimental designs are available on request.





Figures 1-2: Example best-worst scenario for service and design statements

4. Sampling, data collection and data profile

To obtain a broad assessment of the interest in the role of BRT and LRT in the provision of metropolitan public transport, six capital cities in Australia (Sydney, Melbourne, Canberra, Adelaide, Brisbane and Perth) were selected since each has been exposed to real BRT and/or LRT systems as well as, to varying degrees, the debate on proposals to promote LRT or BRT. Introductory information identified whether a respondent was a user or non-user of public transport in the previous month, given our *a priori* belief that differences in preferences between users and non users of public transport is of interest as one way of determining if there exist contextual biases in the preferences of populations towards or against a specific PT investments for reasons that may or may not be linked to the actual investment in BRT and/or LRT.

Given growing evidence that a consumer panel can deliver a representative sample if appropriate quota criteria are applied (see Hatton McDonald et al. 2010, Lindhjem and Navrud 2011), we have drawn on the Pure Profile panel (www.pureprofile.com) for Australia which has many thousands of participants in the chosen study areas. Pure Profile paid each respondent $10 for a completed survey[3].

An online survey was developed that included the best-worst preference screens, four for each of the service and design statements associated with LRT and BRT, and four associated with the more general PT statements linked to the voting preference response. In addition, questions were asked on recent public transport usage, and socioeconomic descriptors of the respondent (as summarised in Table 2). Interviews commenced on 16 May and concluded on 5 June 2013. The final number of interviews are summarised by City in the first row of Table 2.

Table 2: Descriptive overview of total sample and six capital cities

	All Cities	Syd[1]	Mel[1]	Can[1]	Ade[1]	Bri[1]	Perth
Sample Size	1,372	305	293	78	234	214	248
Used PT in last month (%)	55.6	65.5	61.1	37.8	49.1	52.9	49.6
Male (%)	39.8	39.4	42.7	51.2	35.5	38.1	28.7
Annual personal income ($)	58,354	65,267	59,800	76,582	51,212	53,529	54,415
Age (years)	44.1	42.8	43.7	44.2	45.3	42.7	43.2
Full time employed (%)	43.1	50.9	49.5	53.9	42.7	44.9	42.3
Part time employed (%)	19.3	22.6	21.1	19.2	21.4	21.9	21.4
Retired (%)	13.1	11.5	10.7	15.3	15.8	14.1	14.9
Student (%)	4.3	4.8	3.6	0.9	3.4	5.7	5.7

[1]Syd = Sydney; Mel = Melbourne; Can = Canberra; Ade = Adelaide; Bri – Brisbane

The socioeconomic profile of the sample across the six cities shows a very similar mix of stakeholders in terms of average age and occupation status. The incidence of males varies from 28.7 percent in Perth to 51.2 percent in Canberra, and average personal income per annum is at the highest level in Canberra ($76,582), dropping to $51,212 per annum in Adelaide, which is in line with the Australian Bureau of Statistics (ABS) 2011 Census. We have a good representation of users and non-users of PT.

[3] Ethics approval was from the University of Sydney (reference 2013/260).

The evidence of preferences for each of the four public transport images shows an over-riding preference for modern LRT, consistent with our expectations, given what the has been said in the media, and the strong confusion with any form of bus-based system that is typically understood as 'buses in mixed traffic'.

5. Findings

The main focus of this paper is to understand how LRT and BRT are viewed by users and non users of public transport; and in particular to identify where there are areas of common perceptions, and where there are areas of difference. This is better informed by estimating scaled multinomial logit models on the best-worst data and establishing relative weights that represent the substantive contribution of each statement to the utility of a package of public transport initiatives[4].

Since the statements in the service and design experiments are written out as comparators of LRT and BRT (being described as LRT compared to BRT or BRT compared to LRT), statements that result in positive parameter estimates work in favour of an initiative associated with BRT or LRT, and statements with negative parameter estimates work against the initiative.

The approach we have adopted begins with the evidence from the voting model. We are particularly interested in whether use vs. non use of public transport has an influence on stakeholder preferences, and so we have estimated SMNL models where separate parameter estimates are obtained for each statement for users and non-users (in the last month) of public transport. With four choice sets per respondent for each of the three best-worst experiments, we obtained 8,212 observations per model. The overall goodness of fit (adjusted pseudo R^2) for design, service and voting models is respectively 0.156, 0.154, and 0. 209.

The key findings from the voting preferences model are summarised in Figure 3. The upper part of Figure 3 displays the marginal utility (or disutility) for each statement for each segment (i.e., user and non-user of public transport); the bottom representation shows the percentage change in marginal utility between users and non users of public transport for each statement. To ensure that the key findings are not cluttered by the large amount of potential information that can be obtained from each BW experiment, the paper next focusses on the most important statements in terms of relative marginal utility identified by Figure 3, noting that each parameter is interpreted relative to a base statement ('Investment package encouraging housing around stations') whose marginal utility is set to zero.

The nine most important statements where MU is in excess of 1.5 for users are, in order of relative importance: fast overall journey time to destination including getting to and from the station or stop, frequent services, low fares, quick journey times, value for money for the taxpayer, packages which give an outcome that will last for many years, a network that is cost effective to operate, systems that give wide network coverage, and interchanges between services and modes (bus, train, ferry) if this makes overall journey times quicker. These same statements are also in the top nine for non users, but not in the exact same order.

Of these nine statements, five relate to service levels. These service-related attributes should in principle be independent of mode, although there may be a perceived bias in favour of a particular public transport mode, based on experience in usage and/or accumulation of knowledge from many sources including observation. Only frequent services and interchanges have a large difference between the MU of PT users and non-PT users. This suggests that, apart from frequent services, all other marketing on important statements can be the same for users and non-users.

[4] Including error components did not change the parameter estimates, and all error component parameter estimates investigated were very statistically insignificant.

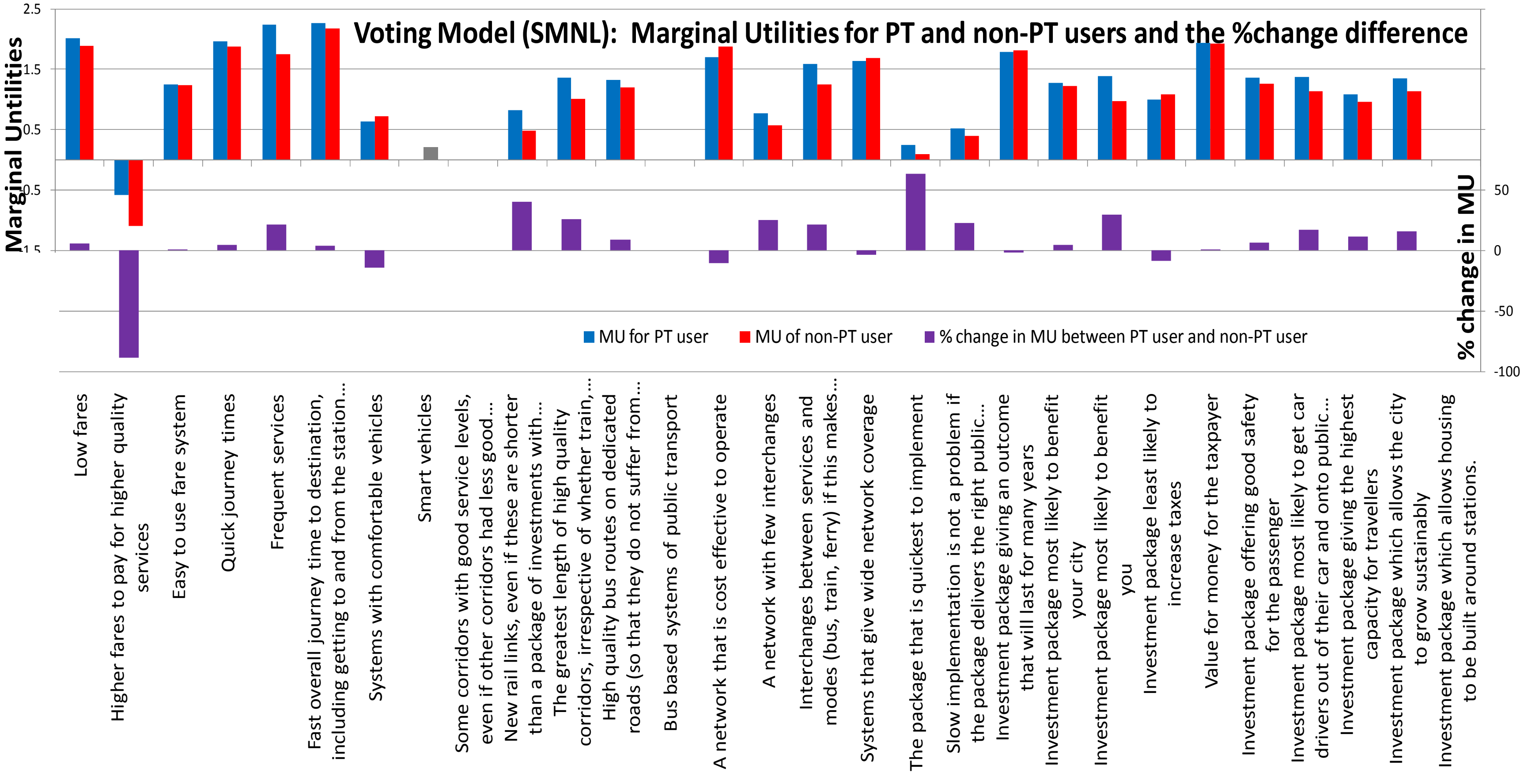


Figure 3: Contrasts of public transport users and non users voting preferences

The next stage in interpretation involves a mapping between the nine voting attributes identified in Figure 3 and each of the set of design and service attribues, as summarised in Table 3.

Table 3: Mapping of voting preferences with design and service preference statements

	Service		Rank		Voting	Rank		Design	
Cleanliness	Cleaner looking			Fares	Higher fares for higher quality services		7	Access	Stops nearer to more people
Cleanliness	Cleaner			Fares	Easy to use fare system		7	Access	Less stops so need to walk further to stop/station
Cleanliness	Cleaner seats		3	Fares	Low fares		7	Access	Better network coverage
Cleanliness	Cleaner on the outside		2	Frequency	Frequent services			Cost	More likely to be funded with private investment
Cleanliness	Cleaner stop/stations		1	Frequency	Fast overall journey time		8	Cost	System is cheaper
Comfort	Crowding makes travel horrible		4	Frequency	Quick journey times		8	Cost	Lower operatinag costs
Comfort	More comfortable			Mode	High quality bus on dedicated routes		8	Cost	Lower operating costs per person carried
Comfort	Better comfort level			Mode	Systems with comfortable vehicles		8	Cost	Lower maintenance costs
Interchange	Require less transfers	9		Mode	Bus based systems of public transport			Cost	Quicker to build and put in operation
Perceptions	More modern looking and more appeal			Mode	Smart vehicles		5	Cost	Better value for money to taxpayers
Perceptions	Car drivers more likely to transfer			Mode	Some corridors with good service levels, even if other corridors had less good service levels			Economy	Provide more opportunities for land redevelopment
Perceptions	More sexy and not boring			Mode	New rail links, even if these are shorter than with bus based services			Economy	Provide more focussed development opportunities
Quality	Easier boarding			Mode	The greatest length of high quality corridors, irrespective of mode			Economy	Support higher population and employment growth
Quality	Better quality of service			Network	A network with few interchanges			Economy	Higher long term benefits
Safety	Safer travelling		9	Network	Interchanges between services/modes if this gives quicker overall journey times			Economy	House prices will rise faster around stops/stations
Safety	Safer stops		7	Network	Systems that give wide network coverage	7		Economy	More opportunity for new housing
Safety	Better personal security		7	Network	Systems that give wide network coverage	7		Economy	Improves surrounding properties more
Speed	Faster travel times	1		Network	A network that is cost effective to	8		Economy	Creates more jobs
Speed	Greater reliability			Multi dimensional Package	The package that is quickest to implement			Environment	Less polluting
Speed	More frequent	2		Multi dimensional Package	Slow implementation OK for the right package			Environment	Building will cause less disruption to roads in the area
Speed	Less service delay			Multi dimensional Package	Investment package giving an outcome that will last for many years	6		Environment	More environmentally friendly
More coverage	Greater network coverage	7		Multi dimensional Package	Investment package most likely to benefit your city			Service Quality	More likely to have level boarding
				Multi dimensional Package	Investment package most likely to benefit you			Service Quality	Quieter
				Multi dimensional Package	Investment package least likely to increase taxes			Service Quality	Stops have greater visibility
				Single objective package	Investment package offering good passenger safety			Service Quality	Lower accident rates
				Single objective package	Investment package most likely to get car drivers to shift to public transport			Service Quality	Provide more comfort for travellers/personal security for drivers
				Single objective package	Investment package giving the highest capacity for travellers			Service Quality	Service looks faster
				Single objective package	Investment package which allows the city to grow sustainably		6	Sustainability	More successful for cities
				Single objective package	Value for money for the taxpayer	5	6	Sustainability	More permanent
				Single objective package	Investment package encouraging housing around stations.		6	Sustainability	More liveable environment
							6	Sustainability	Greater long term sustainability
							6	Sustainability	Brings more life to the city
							6	Sustainability	More likely to be still in use in 30 years time

The nine most important attributes identified in Figure 3 are categorised as service (red) or design features (blue) in the middle column of Table 3 and are mapped to service and design attributes in the adjacent columns. The one green block in the voting column, low fares, does not map to either service or design attributes of the experiment, but its importance to voters must be taken as a signal to politicians about the level of service required and it would be interesting to follow up to see if the electorate would like to see additional funds being switched to supporting fares from within transport (switch from infrastructure to revenue) or from other portfolios to transport..

In Figure 4, the grey bars highlight the attributes that have marginal utilities that are not statistically significantly different from zero (i.e., the base statement), treating the fixed parameters as insignificant in this respect. The top row compares the PT user's perceptions of statements favouring BRT contrasted with LRT. The bottom row compares non-PT user's perceptions of statements favouring LRT contrasted with BRT with respect to the attributes which appear important in voting. The attributes which appear important in voting are highlighted with overlayed shading. The first three design attributes relate to the voting attribute 'systems that give wide system coverage', of which the best match is the third attribute, 'better network coverage'. Overall the evidence hints at product differentiation; both PT users and non PT users obtain additional utility from bus (BRT), relative to the base, from the better accessibility of bus (BRT) over LRT. For the best match (better network coverage) this is stronger for PT users than for non-PT users. The second attribute ('less stops so need to walk further to stop/station') is not significant for PT users, while the first attribute ('stops nearer to more people') lends support to the third attribute.

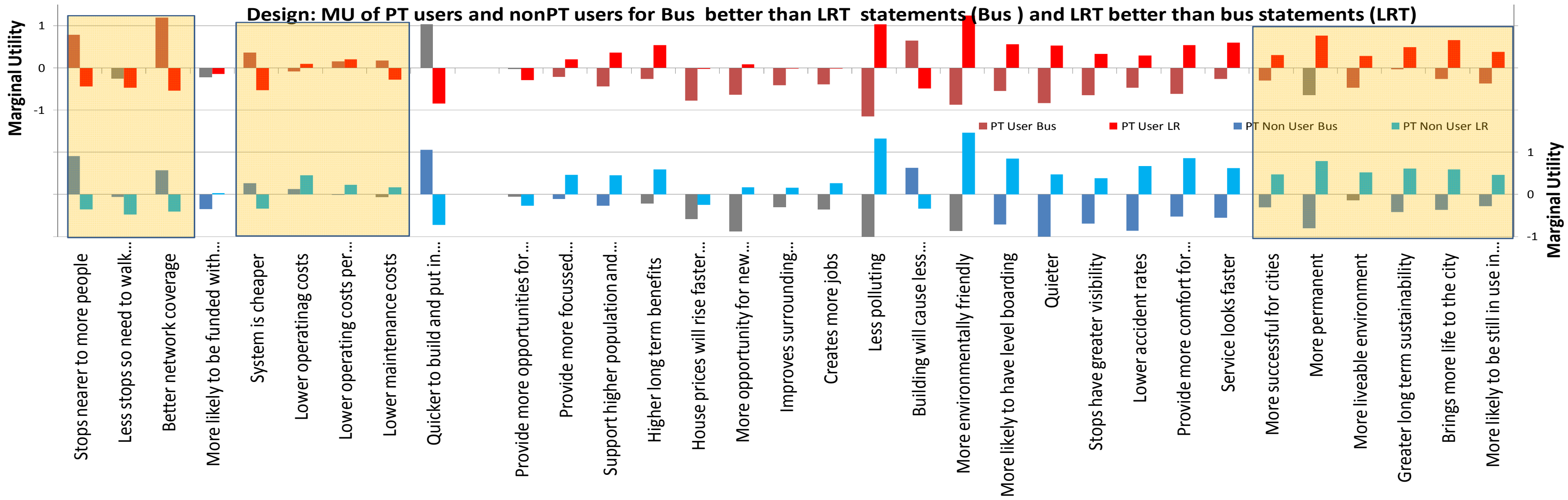


Figure 4: Mapping of public transport users and non users voting and design preferences

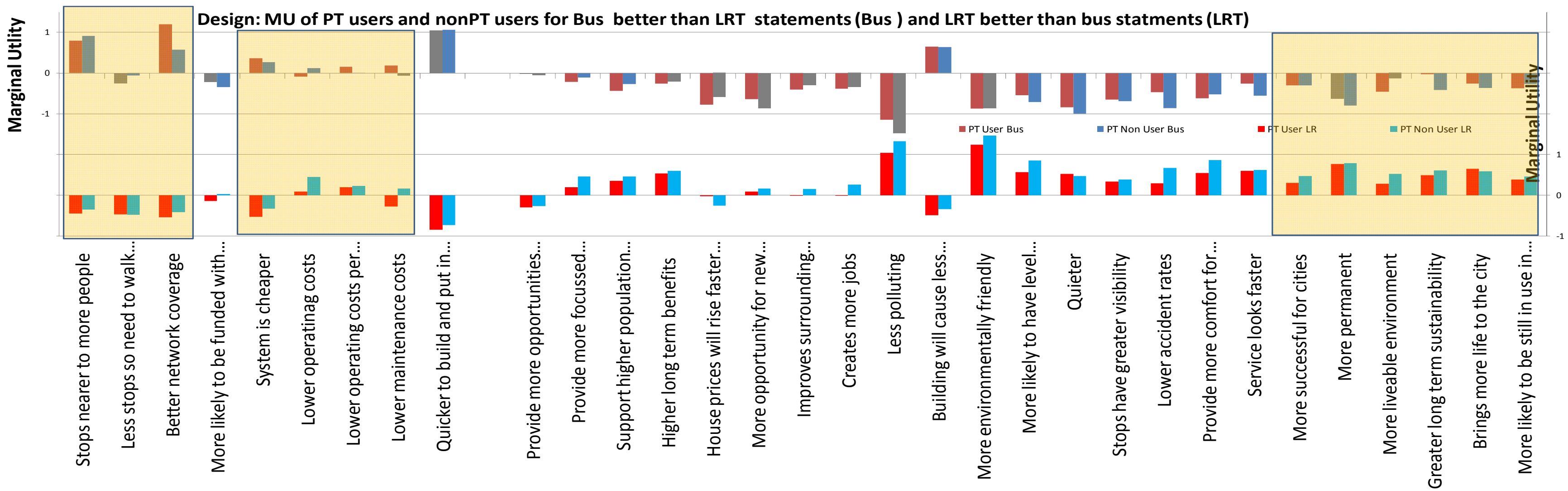


Figure 5: Mapping of public transport users and non users voting and design preferences

The second set of design attributes relate to the voting attribute 'A network that is cost effective to operate'. Four of the cost attributes would appear relevant. Relative to the base statement (i.e., 'buses in a bus lane or dedicated corridor provide better value for money to taxpayers than light rail (trams))', for the design attribute 'the system is cheaper', PT users perceive LRT as being more negative, and whilst the non-PT users have a similar pattern, it is less strong. Otherwise the perceptions are insignificant or small. The conclusion here is perhaps that cost effectiveness is not a design issue.

The final group (the far right block in Figure 4) relate to the voting attribute 'investment package giving a result that will last for many years'. The closest match is the design attribute: 'more likely to be still in use in 30 years time', which shows a stronger reaction by non-PT users (less negative for bus (BRT) and more positive for LRT) as compared to PT users. For the other attributes, overall, LRT is seen by both PT users and non-PT users as being more sustainable than bus (BRT), relative to the base; however many of the parameter estimates are not statistically significantly different from zero (the base). The voting attribute 'value for money for the taxpayer' is exactly matched in the design set, but is the base design statement for LRT.

Figure 5 decomposes the data a different way so as to present perceptions about bus (BRT) and LRT, also for PT users and non users. In relation to the same voting attributes discussed above in Figure 4, for the first block of attributes, Figure 5 highlights the noticeable difference in perceptions between PT users and non users in relation to the 'better network coverage for bus' (the top row), whereas the difference in perception for LRT between PT users and PT users is considerably less marked (the bottom row). For the second group, the perceptions of 'lower operating cost' and 'lower maintenance cost' is markedly different for bus (BRT) and LRT between the PT users and non users. For the third group, there is a marked difference in PT users and non users for the 'more liveable neighbourhood'. Interestingly, PT users' preferences suggest a higher marginal disutility than non users for bus (BRT) statements; however this difference is less marked in the LRT statements. 'Greater long term sustainability' has a similar effect, being more marked for the bus (BRT) statements and less marked for the LRT statements

The mapping between voting and service attribute preferences (Figures 6 and 7) is considered next. As with Figure 4, the top row of Figure 6 presents PT users perceptions of bus (BRT) and LRT, and the bottom row non PT user perceptions. Similarly, the overlayed shading identifies the service attributes which appear important in voting.

The first shaded block relates to 'less transfers', which is mapped to the voting attribute 'interchanges between services and modes if this makes overall journey times quicker'. In the service attributes, this shows that, relative to the base, a positive utility for bus but it is not significantly different from the zero base for statements favouring light rail. For the second shaded block, faster travel times (linked with the top and fourth most important voting attributes), this is shown to be relatively important, relative to the base, with greater utility being achieved from statements favouring LRT. For more frequent services (the third block), the second most important voting attribute, the marginal utility for bus relative to the base is the largest of all significant perceptions, whilst the equivalent for public transport users in relation to LRT favoured statements is close to zero. Of the service attributes that map to the important voting attributes, 'more frequent services' is the only one showing big differences for users between bus (BRT) and light rail, and is an area where marketing could be used to show that buses too can provide more frequent services on dedicated roads. The final attribute of importance to voting (the right most block) is 'the greater network coverage' and here the marginal utility for statements favouring bus (BRT) for users are statistically insignificant, with the equivalent statement for light rail being close to zero.

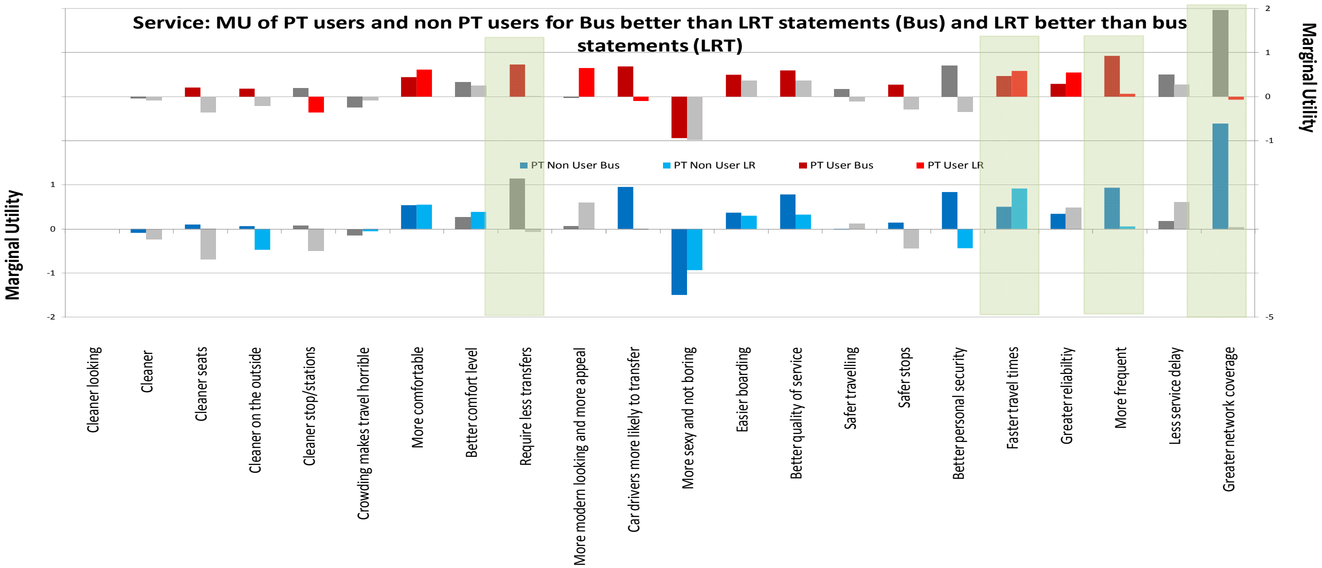


Figure 6: Mapping of public transport users and non users voting and service preferences

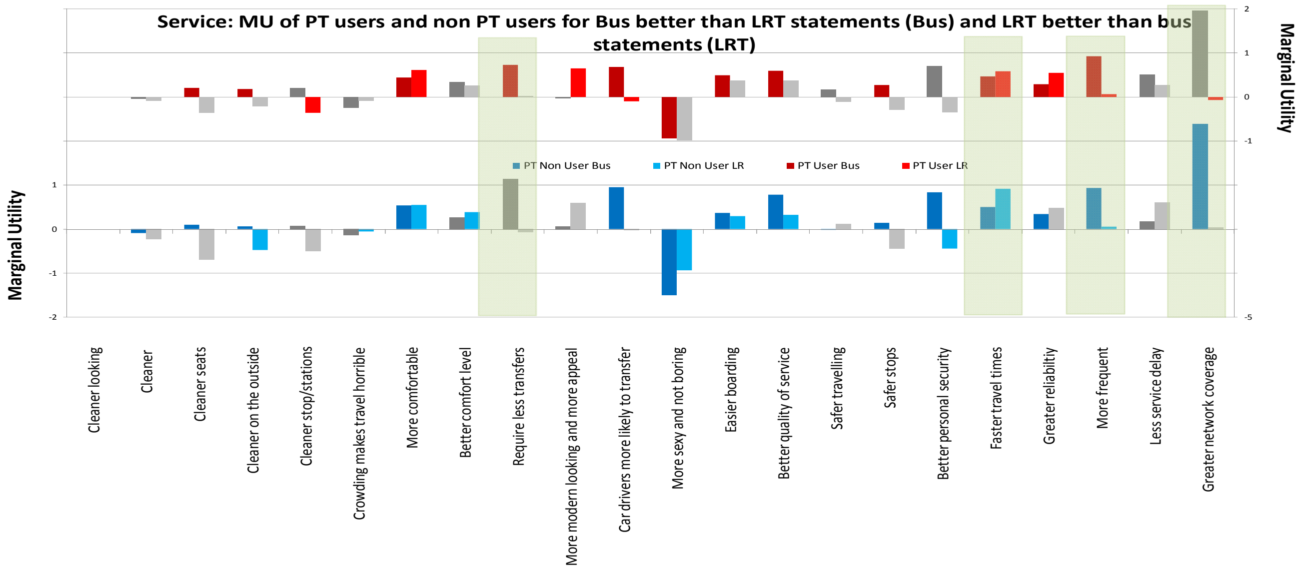


Figure 7: Mapping of public transport users and non users voting and service preferences

Aside from the identified mapping of service attributes that directly relate to voting attributes, a high marginal utility relative to the base is associated with comfort and bus (BRT) favouring statements being more likely to make car drivers transfer (possibly because they perceive bus (BRT) to be more widespread throughout the metropolitan PT network compared to the limited geographical catchment of LRT, as highlighted in the response to 'greater network coverage'), and greater reliability, with the first and last of these providing a higher marginal utility for statements favouring light rail.

The bottom row of Figure 6 compares the perceptions associated with each statement favouring bus and light rail of non users of public transport. In relation to the question of interchanges (or transfers), both attributes are not significantly different from the base. However for faster travel times, more frequent services and greater network coverage, the directions are similar to users but with more difference between the marginal utilities for statements favouring bus (BRT) and LRT. The biggest difference for non-users comes from the 'greater network coverage' attribute where non users perceive the bus mode as offering significantly greater marginal utility than light rail, relative to the base. This is a very important finding.

Finally, on the quality of service type attributes: 'ease of boarding, 'personal security, 'buses in a bus lane or dedicated corridor provide a better quality of service than light rail (trams)' and 'Light rail (trams) provide a better quality of service than buses in a bus lane or dedicated corridor', the marginal utility for bus (BRT) favouring statements is much greater than for LRT.

Looking at Figure 7, the top row compares the perceptual responses of users and non users to statements favouring bus over light rail. The statements covered by the shaded areas, indicating that these attributes are important to voting, show very similar marginal utilities between users and non users for frequency and faster travel times, whereas the responses for interchanges (requiring less transfers) and greater network coverage show much bigger differences, given the insignificance of one of the parameters for each of these pairs. The quality of service attributes are also showing up as important, with noticeable differences being identified in the direction expected for statements favouring bus and light rail.

The bottom row compares the perceptual responses of users and non users to statements favouring light rail over bus. With the exception of faster travel times, there is a higher marginal utility for statements favouring light rail by non public transport users. The quality of service attributes for non users appear to be more certain, relative to the base, given the insignificance of many of the parameters.

6. Examining aggregate attribute profiles

Another way of examining the evidence is to aggregate the marginal utility associated with each statement that is grouped under the generic themes in Table 3 such as fares, frequency and mode. The ability to aggregate the contribution to preferences is permissible given that the model is linear additive in the statements. To control for the number of statements that are statistically significant contribution to overall utility, the sum of the marginal utilities is divided by the number of statistically significant statements in each group (treating non statistical significance as a zero contribution). The findings are summarised in Figures 8-10, respectively for voting, design and service preferences.

The categorised representation in Figure 8 confirms what we have found in Figure 3; namely that there is little difference between the average marginal utility of users and non PT users in response to the factors which would make them vote for particular attributes. The base is the single objective package (i.e., 'investment package encouraging housing around stations'). Interestingly, the average marginal utility for non users is always lower, for each category, than users, suggesting that users may well receive more additional utility from public transport through their use.

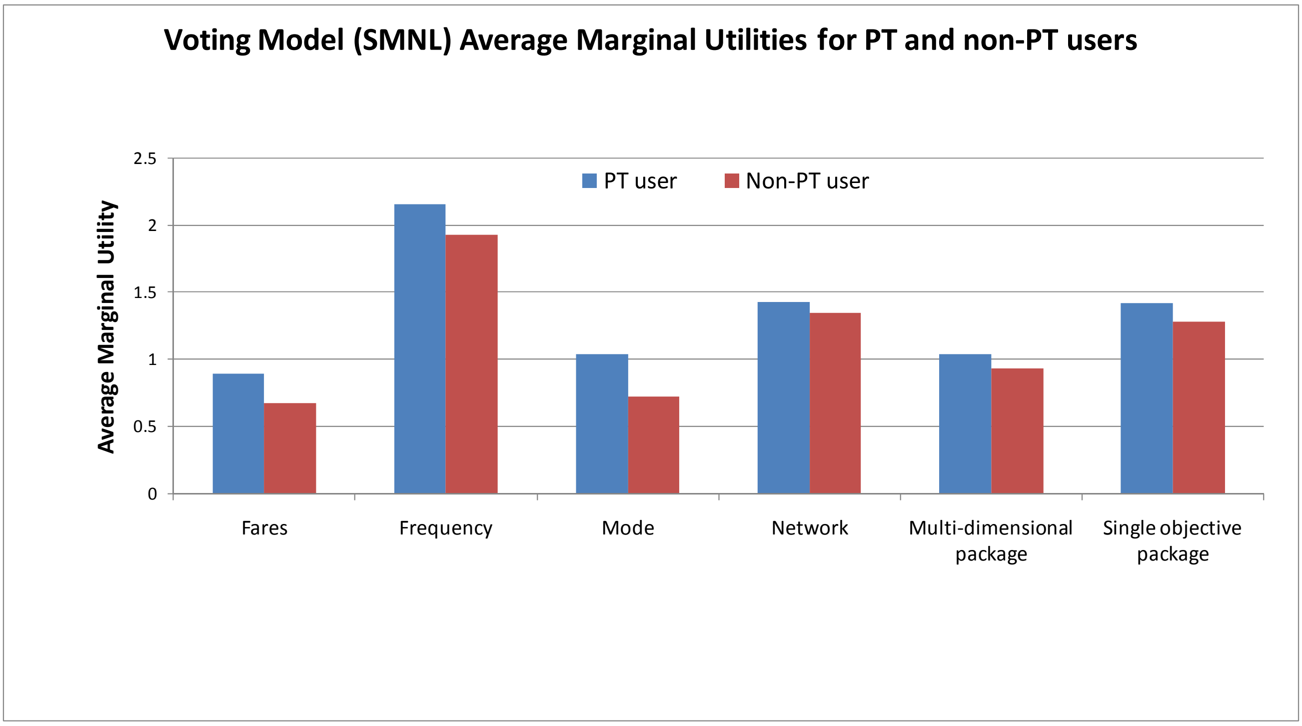


Figure 8: Aggregated contribution to voting preferences

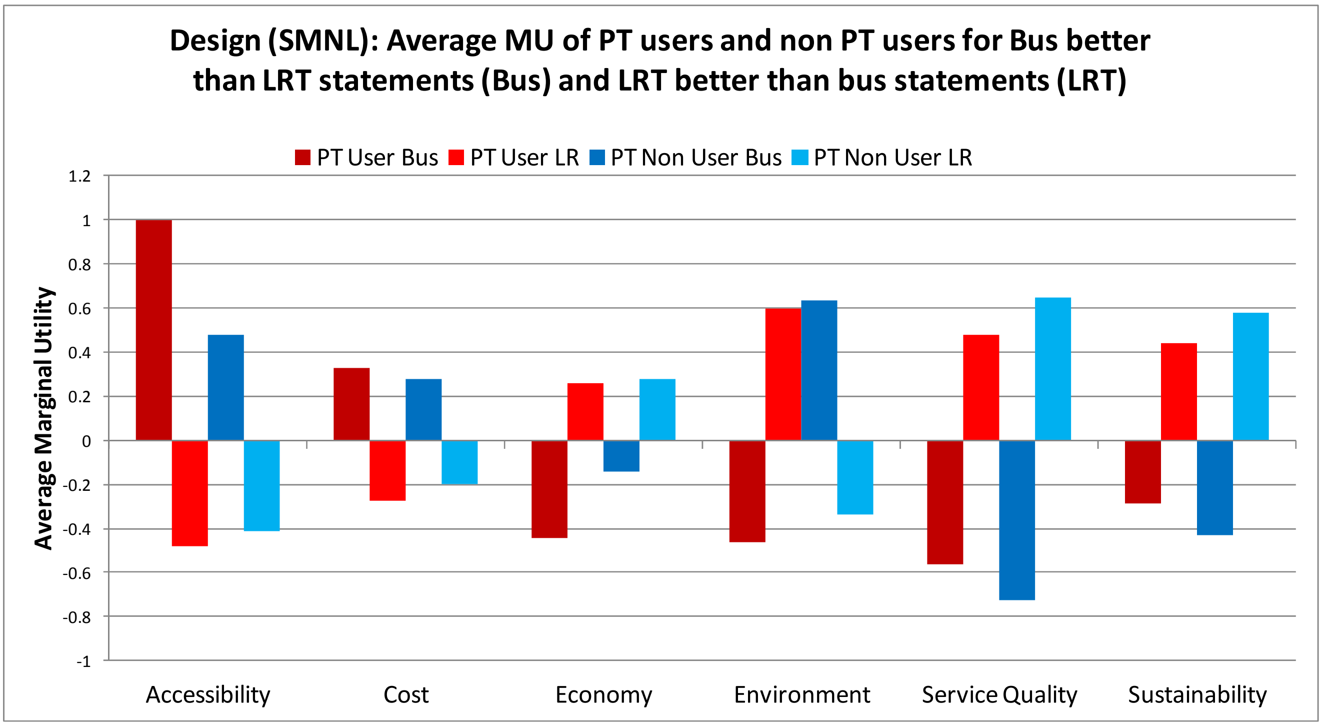


Figure 9: Aggregated contributions to design preferences

In Figure 9, associated with the grouping of design attributes, the base attribute is included in the cost category. For users, the average marginal utility of accessibility of bus (BRT) favouring statements is positive but negative for LRT, with similar positive and negative average marginal utilities for cost. For economy focussed attributes, the average marginal utilities for users is negative for bus (BRT) favouring statements but positive for LRT favouring statements, and this is mirrored for the environment, service quality and sustainability categories, although the magnitudes are different.

For non users, the pattern is very similar although in general the average marginal utility is less extreme in the difference between statements favouring bus (BRT) and LRT, apart from the Environment category. The exception to this is service quality, where non users perceive a much greater average disutility from bus (BRT) favouring statements and much greater utility from LRT favouring statements. The Environment category shows a different pattern, with non users having an average marginal utility which is opposite in sign to the users for the different statements.

Figure 10 summarises the aggregated evidence for the service attributes. For cleanliness, both users and non-users have positive average marginal utilities for the statements favouring bus (BRT); in contrast, users and non users associate noticeable marginal disutility in the statements favouring LRT, for reasons that are unclear. Comfort is associated with positive average marginal utility for all users and non users, although users perceive greater average marginal utility from statements favouring LRT, whereas the reverse is true for non-users. A similar pattern is evident for the speed category of attributes as for comfort. Only the bus (BRT) users' marginal utility for interchanges is significant, and is strongly positive for bus (BRT) favouring statements. Both users and non PT users have significant and similar positive average marginal utility for the way in which bus (BRT) provides additional coverage. This is one of the strongest pieces of evidence in support of BRT, which hints at a strong message of the appeal of BRT over LRT.

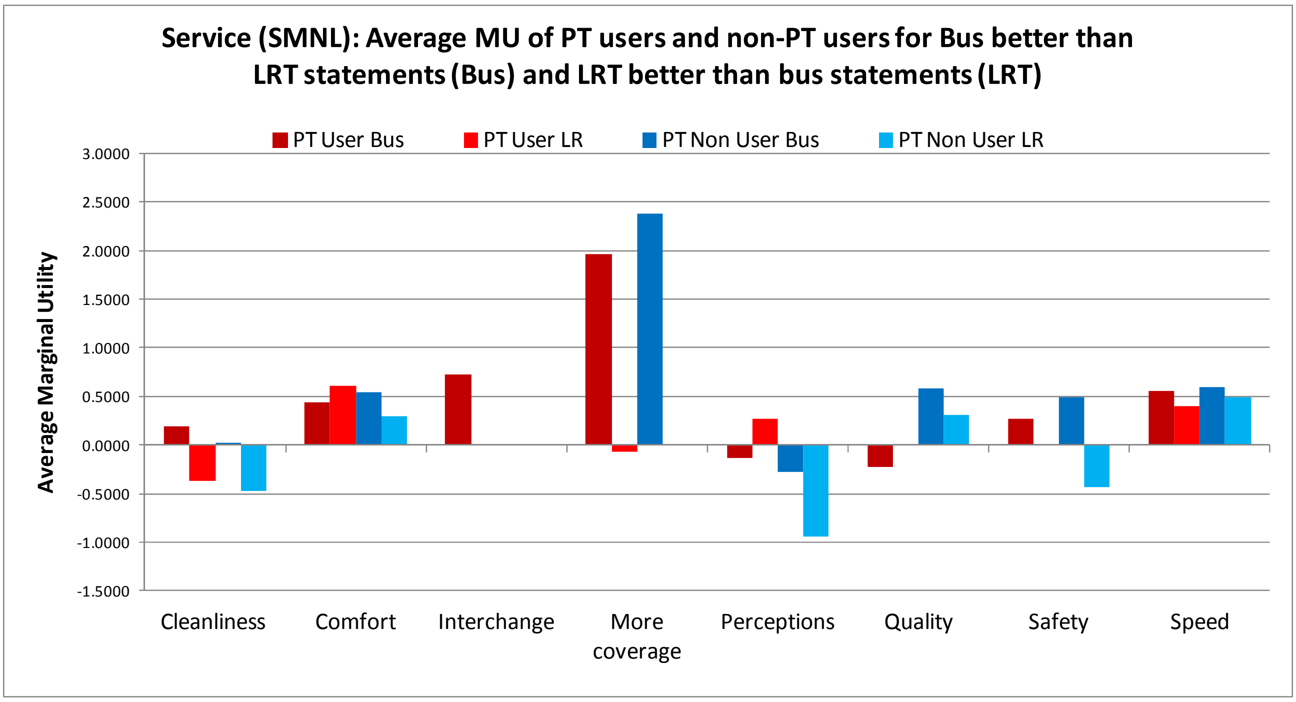


Figure 10: Aggregated contributions to service preferences

The grouping under 'perceptions' (e.g., more modern looking and more appeal, car drivers more likely to transfer, more sexy and not boring) of users and non-users are similar and average as a disutility, except for the positive marginal utility by PT users in respect of statements favouring LRT. The average disutility of non users for statements favouring LRT, however, is much stronger. This is also an important finding which suggests that non users of PT are far less supportive of LRT than bus (BRT) on the perceptual dimensions such as 'better quality of service', 'personal security', 'ease of boarding', and 'car drivers more likely to transfer' as confirmed in Figures 6 and 7. There is mounting evidence to support the relative appeal of bus (BRT) over LRT, although it is non-users of PT that deliver this advantage which is often counter to the positions of PT users. One suspects that this is linked to the predominant role of bus in mixed traffic throughout a metropolitan area (even where there is a growing amount of dedicated corridor treatment, as in Brisbane); in contrast to LRT which is typically available in limited geographical settings, and has some amount of dedicated corridor. Under the category of 'quality', for PT users the average marginal disutility for statements is only significant for those statements favouring bus (BRT); in contrast the average marginal utility for non PT users is positive, with bus (BRT) being better than LRT, reinforcing a similar finding in the 'perceptions' grouping. For the category 'safety', both users and non PT users have a positive average marginal utility for bus (BRT) favouring statements, although the average marginal utility is greater for users; contrarily, the average marginal utility is negative for non users for LRT favouring statements, suggesting a perception that the bus (BRT) mode is safer. This evidence is reinforced by the findings in Figures 6 and 7 that show clearly that personal security is the overriding underlying dimension of safety, and bus (BRT) wins out over LRT, possibly because of the closeness of the driver to the passengers.

7. Conclusions

This paper has presented an approach and empirical evidence designed to identify the main influences on stakeholders' preferences in support of LRT versus BRT and to investigate differences between users and non users of public transport. We have identified the most important influences that stakeholders think about when forming opinions and preferences about the relative advantages of LRT and BRT, be the stakeholder a user or non-user of public transport.

The emphasis in this paper has been on seeking out empirical insights, and hence signals, that might guide us in defining the main influences on stakeholders' positions in respect of the perceptual alignment with BRT and LRT design and service attributes. The distinction between users and non users of public transport has proven to be especially informative. In particular; drilling down to specific statements and their significance in the various aggregated groupings on attributes (as illustrated in Figures 9 and 10), shows greater (relative) support for BRT (compared to LRT) from non users of PT compared to users of public transport (which is an important finding in the Australian context of car dominance where car travel accounts for typically 70 percent of all travel). This suggests there is a possibility that, although physical image may play an important role in influencing preferences either in favour of or against BRT compared with LRT (as suggested in Table 2[5]), the power of the image can (and should) be counteracted when specific relative strengths of bus (BRT) are focused on. A suggested way forward to resolve this potential conflict is to identify the types of individuals who have a strong image bias in favour of LRT and to promote directly to them the virtues of bus (BRT) over LRT in delivering at least as good a service and broad benefit outcome. Hensher and Mulley (2013) have undertaken a separate exercise to identify the socioeconomic and travel profiles of such individuals using a generalized ordered logit model in which the dependent variable is the rating scale in Figure 4 for each of the four images. They find that socioeconomic variables do not provide a sufficiently strong basis for market segmentation for a targeted marketing campaign to better inform stakeholders as a way to neutralize or sanitise the influence of image alone.

The mapping between the evidence which defines voting preferences (not aligned explicitly with BRT or LRT), with design and service attributes of BRT and LRT provides an appealing

[5] Which suggests that experience in using public transport conditions preferences, with a move towards greater relative support for BRT from users of public transport, which is encouraging, even though on balance there is a much greater overall support for the image of LRT (Table 4).

framework within which to select candidate attributes for the design of a marketing strategy. Critically, we need to ensure that the selected attributes are both important to stakeholders and sufficiently differentiated with respect to BRT and LRT. This will provide a basis to a marketing campaign to close the perceptual gap where we believe there is a strong case for BRT, which currently remains a barrier. What will remain a challenge, however, is the strong hold of emotional ideology, which may be difficult to overcome. But we are encouraged by the evidence which suggests that real experience in using public transport reveals a stronger recognition of the appeal of BRT compared to LRT, even when LRT remains more popular.

In conclusion, this investigation suggests that the following 13 attributes should be embedded in a marketing strategy, and carried forward in ongoing research into a discrete choice experiment where we focus in more detail on the choice between BRT and LRT. A very strong finding is the attraction of BRT in delivering greater network coverage, and value for money to the taxpayer.

Use-related attributes:

- Travel times (including getting to and from the station or stop)
- Service frequency (peak and off peak)
- Fares
- Ease of boarding
- Ease of transfer
- Personal security

Societal-related attributes:

- Value for money for the taxpayer outlays per passenger kilometre (or per in-service kilometre, capital cost per passenger)
- Environmental friendliness (fuel type, noise)
- Liveability of a city/neighbourhood
- Time to construct and open for operation
- Life of investment (permanence over time, greater long term sustainability)
- Network coverage (including less stops, and access to stops/stations (stop spacing), routes and route kilometres)
- A network that is cost effective to operate (operating costs per passenger)

8. References

Auger, P., Devinney, T.M. and Louviere, J.J. (2007) Best-Worst scaling methodology to investigate consumer ethical beliefs across countries, *Journal of Business Ethics*, 70, 299–326.

Canadian Urban Transit Association (2004) Bus Rapid Transit: A Canadian perspective, Issues Paper #10, CUTA, Toronto.

Chaloner, K. and Verdinelli, I. (1995) Bayesian Experimental Design: A Review, Statistical Science, 10(3), 273-304.

Chapman, R.G. and Staelin, R. (1982) Exploiting rank ordered choice set data within the stochastic utility model, *Journal of Marketing Research*, 19, 288-301.

Cirillo, C., Eboli, L., and Mazzulla, G. (2011) On the asymmetric user perception of transit service quality, *International Journal of Sustainable Transportation* 5(4), 216-232.

Cohen, E. (2009) Applying best-worst scaling to wine marketing, *International Journal of Wine Business Research*, 21(1), 8–23.

Collins, A. T., and Rose, J. M. (2011) Estimation of stochastic scale with best-worst data. Manuscript, Institute of Transport and Logistics Studies, University of Sydney.

Cornwell, P. and Cracknell, J. (1990) The Case for Busway Transit, *PTRC 18th Summer Annual Meeting***,** 1990. (This paper is a summary of TRL Research Report 329 and Overseas Road Note 12 of the Transport Research Laboratory, Berkshire, UK).

dell'Olio, L., Ibeas, A. and Cecìn, P. (2010a) The quality of service desired by public transport users, *Transport Policy*, doi:10.1016/ j.tranpol.2010.08.005.

dell'Olio, L., Ibeas, A., and Cecìn, P. (2010b) Modelling user perception of bus transit quality, *Transport Policy* 17, 388-397.

Denis Johnstone and Associates (1992) Canberra Transport Study: Study of Future Publc Transport Options, Report on Stage 1, Report prepared for the ACT Administration, Canberra, September.

Eboli, L. and Mazzulla, G. (2008a) An SP experiment for measuring service quality in public transport, *Transportation Planning and Technology* 31(5), 509-523.

Eboli, L. and Mazzulla, G. (2008b) Willingness-to-pay of public transport users for improvement in service quality, *European Transport* 38, 107-118.

Eboli, L. and Mazzulla, G., (2010) How to capture the passengers' point of view on a transit service through rating and choice options, *Transport Reviews* 30(4), 435-450.

Estache, A. and Gomez-Lobo, A. (2005) Limits to competition in urban bus services in developing countries, *Transport Reviews*, 25 (2), March, 139-158.

Flynn, T. N., Louviere, J.J., Peters, T.J. and Coast, J. (2007) Best-Worst scaling: what it can do for health care research and how to do it, *Journal of Health Economics*, 26, 171–189.

Gotwalt, C. M., Jones, B. A., Steinberg, D. M. (2009) Fast computation of designs robust to parameter uncertainty for nonlinear settings, *Technometrics*. 51, 88-95.

Hass-Klau, C. and Crampton, G. (2002) Future of Urban Transport: learning from success and weaknesses: Light Rail, Environment and Transport Planning, Brighton, UK.

Hatton MacDonald, D., Morrison, M., Rose, J.M. and Boyle, K. (2010) Untangling differences in values from internet and mail stated preference studies, *Fourth World Congress of Environmental and Resource Economists*, Montreal Canada, June 28– July 2.

Hensher, D.A. (1991) Hierarchical stated response designs and estimation in the context of bus use preferences, *Logistics and Transportation Reviews*, 26 (4), 299-323.

Hensher, D.A. (1999) Bus-based transitway or light rail? continuing the saga on choice versus blind commitment, *Roads and Transport Research*, 8(3), September 3-21.

Hensher, D. A. (2001) Service quality as a package: what does it mean to heterogeneous consumers? Paper presented at the *9th World Conference on Transport Research*, Seoul, Korea, 22–27 July.

Hensher, D.A. and Waters, W.G. II (1994) Light Rail and Bus Priority Systems: Choice or Blind Commitment?, in *Research in Transportation Economics*, Vol. III (ed. B. Starr Macmullen), JAI Press, Greenwich, Connecticut, 139-162.

Hensher, D.A. and Prioni, P. (2002) A service quality index for area-wide contract performance assessment, *Journal of Transport Economics and Policy*, 36, 93-113.

Hensher, D.A. and Mulley, C.M. (2013) Systematic drivers of preferences for BRT and LRT images: a generalised ordered choice application, Institute of Transport and Logistics Studies, the Business School, the University of Sydney, August.

Hensher, D.A. and Rose, J.M. (2012) The influence of alternative acceptability, attribute thresholds and choice response certainty on automobile purchase preferences, submitted to *Journal of Transport Economics and Policy,* 46 (3), 451-468.

Hensher, D. A., Mulley, C. and Yahya, N. (2010) Passenger experience with quality-enhanced bus service: the tyne and wear 'superoute' services, *Transportation*, 37 (2), 239-256.

Hensher, D.A., Stopher, P.R. and Bullock, P. (2003) Benchmarking and service quality at a market segment level *Transportation Research Part A*, 37, 499-517.

Kain J. F. (1988) Choosing the wrong technology: or how to spend billions and reduce transit use. *Journal of Advanced Transportation.* 21, 197-213.

Lindhjem, H. and Navrud, S. (2011) using internet in stated preference surveys: a review and comparison of survey modes, *International Review of Environmental and Resource Economics*, 5 309-351.

Louviere, J.J. and Islam, T. (2008) A comparison of importance weights and willingness-to-pay measures derived from choice-based conjoint, constant sum scales and best-worst scaling, *Journal of Business Research*, 61, 903–911.

Kessels, R., Bradley, B. Goos, P. and Vandebroek, M. (2009) An Efficient Algorithm for Constructing Bayesian Optimal Choice Designs, *Journal of Business and Economic Statistics*, 27(2), 279-291.

Kuhfeld, W. F., and Tobias, R.D. (2005) Large factorial designs for product engineering and marketing research applications, *Technometrics*, 47(2), 132-141.

Mackett R.L. and Edwards M. (1996a) Guidelines for planning a new urban public transport system. *Proceedings of the Institution of Civil Engineers: Transport.* 117, 193-201.

Mackett R. L. and Edwards M. (1996b) An expert system to advise on urban public transport technologies. *Computers, Environment and Urban Systems*. 20, 261-273.

Marcucci, E. and Gatta, V. (2007) Quality and public transport service contracts. *European Transport* 36, 92-106.

Marley, A., Louviere, J.J. (2005) Some probabilistic models of best, worst, and best-worst choices. *Journal of Mathematical Psychology*, 49, 464-480.

Marley, A. A. J., and Pihlens, D. (2012) Models of best-worst choice and ranking among multi-attribute options (profiles), *Journal of Mathematical Psychology*, 56, 24-34.

Meyer, R.K., and Nachtsheim, C.J. (1995) The coordinate-exchange algorithm for constructing exact optimal experimental designs, *Technometrics*, 37(1), 60-69.

Newman, P.W. and Kenworthy, J.R. (1989) *Cities and Automobile Dependence: An International Sourcebook*, Gower, United Kingdom.

New South Wales Government (2012*) Sydney's Light Rail Future*, NSW Government, Sydney, December.

Paulhus, D. L. (1991) Measurement and control of response bias. In J. P. Robinson, P. R. Shaver, and L. S. Wrightsman (Eds.), Measures of personality and social psychological attitudes, San Diego, CA: Academic Press, 17-59.

Pickrell D. H. (1992) A desire named streetcar: fantasy and fact in rail transit planning. *Journal of the American Planning Association.* 58, 158-176.

Prioni, P. and Hensher, D.A. (2000) Measuring service quality in scheduled bus services, *Journal of Public Transport*, 3 (2), 51-74.

Sislak, K.G. (2000) Bus rapid transport as a substitute for light rail: A tail of two cities, paper presented at 8th Joint Conference on Light Rail Transit, *Transportation Research Board and American Public Transportation Association*, http://www.apta.com/research/info/briefings/documents/sislak.pdf. Accessed 30th July 2013

Smith, N. and Hensher, D.A. (1998) The future of exclusive busways: the Brazilian Experience, *Transport Reviews*, 18,

Swanson, J., Ampt, L. and Jones, P. (1997) Measuring bus passenger preferences, *Traffic Engineering and Control*, June, 330-36.

Yu, J., Goos, P. and Vandeboek, M. (2009) Efficient conjoint choice designs in the presence of respondent heterogeneity, *Marketing Science*, 28(1), 122-135.