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Quality attributes of public transport that attract car users: A research review

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ABSTRACT

The transport sector presents contentious issues with respect to sustainable development, particularly regarding the use of private motorised vehicles in urban areas. Public transport (PT) together with cycling and walking are generally agreed to be sustainable alternatives to private car use. This paper aims to contribute to a better understanding of those aspects of PT quality most likely to attract car users. Toward achieving this aim, relevant research was sought to answer the following two questions: What quality attributes of PT services are attractive to users? And what changes in quality attributes of PT services would encourage modal shift from private motor vehicles to PT? Using a qualitative systematic review, it is concluded that while service reliability and frequency are important PT attributes in general, those attributes most effective in attracting car users are largely affective and connected to individual perceptions, motivations and contexts. Reduced fare promotions and other habit-interrupting transport policy measures can succeed in encouraging car users to try PT services initially. Attributes over and above basic accessibility, reliability and mobility provision, perceived by the target market as important service attributes, must then be provided in sustaining the switch from car use after promotional tactics have expired.

1. Introduction

The transport of humans and goods holds major economic and social importance in maintaining expected standards of consumption and quality of life (Banister, 1996; Gifford and Steg, 2007). The transport sector is also a key contributor to air pollution, and it places considerable demand on non-renewable resources such as oil. The rapid growth of private car use in urban areas not only exacerbates these environmental concerns, but also contributes to social problems such as traffic congestion and poor health (Greene and Wegener, 1997). For the individual, however, car travel is appealing. Compared to other transport alternatives it is generally perceived as more comfortable, flexible and faster for supporting busy lifestyles; it is more private, and it may have more potency as a status symbol or reflection of identity (Jakobsson Bergstad et al., 2011). Land use factors such as urban sprawl and low-density residential areas have also contributed to the appeal of the private car as a relatively convenient means of mobility (Kennedy et al., 2005; Luk, 2003).

Batterbury (2003) argues that current transport conditions, particularly the level of urban private car use, disallow sustainable levels of economic performance, social welfare and environmental resilience. Reducing the demand for private cars in urban areas is therefore a key sustainability aim. In attempts to reduce the negative effects of excessive use of private motorised transport, several potential solutions have been proposed and implemented, with varying success (Loukopoulos, 2007). These approaches include investment in the development of private motor vehicles with less detrimental emissions; city planning and infrastructure measures intended to reduce congestion and provide alternatives to private cars; and tactics (usually policy-related) aimed at influencing the demand for travel.

Public transport (PT) is considered to be a sustainable, viable alternative to private car use (Holmgren, 2007). In the present paper we delve into the current body of research in an attempt to understand those aspects of PT service quality most likely to attract car users. Toward achieving this aim, relevant research is reviewed to answer the following two questions: (1) What quality attributes of PT services are attractive to users? (2) What changes in quality attributes of PT services would encourage modal shift from private motor vehicles to PT?

The research review aims to provide an objective, comprehensive synthesis of the current knowledge of the field. A qualitative systematic review (de Vet et al., 1997; Cooper and Hedges, 1994)

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Table 1
Keywords used in literature search.

Public transport (PT) users	Public trans*, mass trans*, user*, ridership
Car users	Car user*, private vehicle*, private transport*
Service quality	Quality, attitude*, perception*, satisfaction
PT improvement studies	Public transport*, travel demand management, improvement, hard travel demand management/measure*/polic*, public transit, mass transit, bus rapid transit, public trans* service improvement*, public trans* service upgrad*, bus service upgrad*, bus service improvement*

Note. The use of asterisks in the literature search enabled the inclusion of all studies using varied suffixes of the chosen keywords. For example, the search term 'public transport*' would reveal studies using the terms 'public transport', 'public transports', and 'public transportation'.

is considered to be most appropriate since the pool of data is limited and comes from studies that vary considerably in research design, evaluation methods and sample type (Richter et al., 2010, 2011). Attempting to statistically evaluate heterogeneous data by means of a quantitative meta-analysis would not produce statistically meaningful results (Cooper and Hedges, 1994; Lipsey and Wilson, 2001).

In addressing the research questions, the analysis was conducted in two stages. First, on the basis of a review of research on PT quality, an analysis was made of how quality of PT is defined, how it is evaluated, and how it can be improved upon to increase ridership. Second, empirical studies measuring the effects of PT improvements were analysed, taking into consideration the specific improvements targeted and then focusing on studies that targeted car use.

The literature search was conducted using on-line, international journal databases in order to capture the greatest potential range of published academic research in the field. The two general databases searched were the ISI Web of Knowledge (www.isiwebofknowledge.com) and Google Scholar (www.googlescholar.com). The key words used to search for each of the relevant terms are given in Table 1. As a considerable amount of research is conducted by governments and by commissioned private consultancies, it was deemed relevant to consider unpublished studies in the literature search in order to counteract a potential bias of editors and referees toward only publishing results that are statistically significant. Furthermore, as the topic is not only of academic interest, some studies not published in academic journals may hold relevant insight. In an attempt to locate unpublished studies, the literature search was extended to the following organisational sites: International Association of Public Transport (www.uitp.org), KonSULT (www.konsult.leeds.ac.uk), Planning and Transport Research Centre (www.patrec.org), European Local Transport Information Service (www.eltis.org), Federal Transit Administration (www.fta.dot.gov), and Victoria Transport Policy Institute (www.vtpi.org). These sites were chosen because they were referenced by credible academic literature or recommended in correspondence with field experts (Ker, personal communication, March 24, 2010; Taylor, personal communication, March 17, 2010). Studies that did not focus specifically on PT, or where no English version was provided, were excluded from the analysis.

The paper is organised as follows: First, the review of available research regarding the quality of PT services is presented. Second, the analysis of those studies that focused on evaluating the effect of PT service improvements is reported. Third, the review of PT service quality is synthesised with the review of PT improvement studies to determine what aspects of PT service quality are potentially most attractive to car users, as relevant to transport policy. A final section concludes and makes suggestions for further research.

2. Quality attributes of public transport

The assessment and evaluation of quality in PT services seems to be a relatively new undertaking, as almost all studies found addressing this topic were published within the last 15 years. In reports of PT research, the terms 'transport' and 'transit' are interchangeable and refer to the provision of buses, coaches, light and heavy rail, trams and ferries as well as taxis and private hire cars for public use (Balcombe et al., 2004; Parkan, 2002). While the term 'public transport' is predominantly used in Europe, Japan and Australia, the terms 'mass transit' and 'public transit' tend to be used more in North America and Southeast Asia (chiefly China, Hong Kong and Singapore). These terminological conventions are not strict rules, however, and there is some crossover. For example, the term 'public transit' has been used in Greece (Tyrinopoulos and Antoniou, 2008), France (Dersin and Durand, 1995) and Germany (Flade, 1990). The term 'public transport' has been used in Hong Kong (Cullinane, 2003).

A large number of attributes have been proposed in attempts to define PT quality. These attributes may roughly be categorised as physical or perceived. Physical attributes are measured without involving PT users, and assumptions are made about the impacts on PT users. In contrast, to measure perceived attributes, PT user responses must be observed, either directly (e.g., Friman et al., 2001) or indirectly (e.g., Balcombe et al., 2004; Paulley et al., 2006). Table 2 lists and defines the most commonly studied PT quality attributes.

The research revealed an interesting argument regarding Price (including fare structures and tickets and their validity), which was an attribute addressed frequently in the literature. Passengers compare an existing fare to their expectation of a reasonable price, which is the perceived monetary value of the service they believe is actually provided. In a study aiming to develop a standardised PT quality index, Hensher et al. (2003) conclude that lower fares (price) would make important contributions to improved customer perceptions of PT quality, with speed coming a close second. Andreassen (2005) agrees that both fare price levels and speed are critical in affecting customer satisfaction with PT. Interestingly, Hensher et al. (2003) adds that the solution is not to reduce fares because customers perceive existing fares to be too high for the quality of service provided. Rather, suppliers are more likely to achieve improved customer satisfaction by improving quality attributes to meet customers' perceived value of the existing fare price. Eboli and Mazzulla (2008) found fare price and frequency to be the most important PT quality attributes for users. They noted however that their sample comprised largely low-income students, representing a particular market segment, and therefore not necessarily representative of the population.

Personal characteristics—as well as local land use and infrastructure—affect user travel habits and which travel mode

Table 2
Definitions of public transport (PT) service quality attributes.

	Attribute	Definition
Physical	Reliability	How closely the actual service matches the route timetable
	Frequency	How often the service operates during a given period
	Speed	The time spent travelling between specified points
	Accessibility	The degree to which public transport is reasonably available to as many people as possible
	Price	The monetary cost of travel
	Information provision	How much information is provided about routes and interchanges
	Ease of transfers/ interchanges	How simple transport connections are, including time spent waiting
	Vehicle condition	The physical and mechanical condition of vehicles, including frequency of breakdowns
Perceived	Comfort	How comfortable the journey is regarding access to seat, noise levels, driver handling, air conditioning
	Safety	How safe from traffic accidents passengers feel during the journey as well as personal safety
	Convenience	How simple the PT service is to use and how well it adds to one's ease of mobility.
	Aesthetics	Appeal of vehicles, stations and waiting areas to users' senses

they perceive as most desirable to use at any given time. Hensher and Prioni (2002) found that trip purpose had no effect on respondents' stated preference for one of three transport options offering varied quality attributes, while commuting had a weak effect and age had a strong effect, with youth and low-income earner segments (versus older and high-income segments) most commonly asserting that quality improvements were needed. As car ownership is often positively related to income level (Bamberg et al., 2003; Luk, 2003), and PT is an alternative to private motor vehicle use, it could be inferred that youth and low-income earners are using PT more out of necessity than choice and therefore may view it more negatively. Thevathasan and Balachandran (2007) also suggest that user demographics influence both user evaluations on PT service and which attributes users deem as most important. Still other studies point to effects of user expectations that are contingent on experiences with previous and existing PT services (Boisvert, 1998; Tyrinopoulos and Antoniou, 2008).

There may be significant discrepancies between the objective level of quality supplied and evaluated by PT operators and how it is perceived by PT users. Rietveld (2005) claims that PT suppliers systematically overestimate the quality of service provided compared to customer evaluations. Supply-oriented evaluation methods focus on overall, 'average' performance indicators while individual client experiences do not. For example, over the course of a day a bus route may achieve objectively acceptable reliability levels from a supply-oriented point of view in that congestion and delays experienced during peak hours are counter-acted with smooth running during quieter periods. However, it is likely that more customers experience the poor performance during the peak period and also may place more importance on reliability at this time of day due to work or other commitments. Therefore, the PT supplier would evaluate overall reliability of the service more favourably than do the majority of PT patrons. Similarly, Parkan (2002) argues that when a PT supplier conducts service quality evaluations, they are most often evaluating this performance against a list of attributes deemed important by the supplier, rather than attributes deemed important by the PT user. Walker and Donovan (2007) found that changes in patronage in response to changes in PT services were most influenced by the following circumstances: a large real change in route frequency; when patrons were commuters or working-age adults; when the change coincided with service branding and advertising; and when fuel prices were relatively high.

Friman (2004) and Friman et al. (2001) note that patrons' overall satisfaction with the quality of PT is additionally influenced by the experience of 'critical incidents' accumulated over time. A critical incident is a particularly satisfying or dissatisfying encounter, such as a transport interchange that ran particularly smoothly, a particularly rude member of staff, or a trip on a particularly crowded bus. It is claimed that overall customer satisfaction with PT depends on satisfaction with specific quality attributes, as discussed, as well as the persistence in memory of negative or positive critical incidents. PT patrons do not re-evaluate perceptions of PT quality each time they use the service, but instead establish their overall perception over time based on critical incidents.

It follows that being able to define specific attributes that constitute objective, supply-oriented quality of PT is only part of the picture. It is important that quality in PT service as perceived by the user is also closely considered, and that consistently satisfactory levels of that quality are evident over time. While future studies may attempt to develop frameworks for measuring and prioritising quality attributes for PT services, researchers who have performed such studies (see Eboli and Mazzulla, 2008; Thevathasan and Balachandran, 2007; Too and Earl, 2010) agree that it is unlikely that their results will reveal universal standards for what constitutes PT quality. Rather, future studies are also likely to be context-specific and allow limited generalisation. Eboli and Mazzulla (2010) make a relevant point in proposing a combined rating and choice options methodology for user-evaluated PT service quality. They note that while users may be able to easily evaluate the performance and relative importance of isolated PT quality attributes, when it comes to choosing between services that achieve varying levels of multiple attributes, the decision-making process becomes more complex and less predictable. As the decision to travel by PT can be split discretely between deciding to use—or not use—the mode, discrete choice modelling (see Ben-Akiva and Boccara, 1995; Hensher et al., 2003) has been considered useful in assessing the relative values that users place on alternatives. Such attempts therefore reinforce the fact that user perceptions are important in determining PT quality attributes that will ultimately translate into increased ridership.

In summary, the literature review revealed that reliability is a key quality attribute of PT service, with frequency, fare prices, and speed also commonly important. The relative importance of quality attributes in affecting PT demand is however to a large degree dependent on user demographics, personal situations and previous experiences with PT services.

3. Review of public transport improvement studies

From the literature search, 74 PT improvement studies were deemed valid for inclusion (indicated with an asterisk in the

reference list). Almost all focused on improving physical attributes of PT service, rather than perceived attributes. Half (37 of 74) of the studies addressed improvements in perceived attributes in some way and five made these attributes a key focus (Foote, 2004; Friman, 2004; Wall and McDonald, 2007). It is notable that only a subset of the PT quality attributes in Table 2 have been investigated in improvement studies.

An overview of the studies is given in Table 3. Improvement strategies are listed as rows in the table. The columns list the PT quality attributes targeted by each improvement strategy. Targeted quality attributes are assumed by the authors where no explicit information is provided. Most improvement strategies target several quality attributes simultaneously. For instance, Bus Rapid Transit (BRT) initiatives aim to improve speed and reliability by providing priority bus lanes, comfort through building attractive and recognisable stations, and convenience by providing pre-boarding payment systems and innovative, real-time information systems.

In the following, we first discuss each targeted PT quality attribute (in the order listed in Table 3). In a following subsection we highlight the studies targeting car users. These studies provide direct answers to the question about which changes in PT quality encourage modal shift from private vehicles to PT.

3.1. Reliability

As was noted above, reliability has been considered to be a key attribute in determining PT quality (see Cantwell et al., 2009; Filipović et al., 2009; Hensher and Prioni, 2002; Parkan, 2002; Pucher and Kurth, 1995; Rietveld et al., 2001; Too and Earl, 2010). For those studied reviewed, reliability is one of the most frequently addressed attribute through implementations of BRT, integrated PT systems, extended services and rail substitutes of bus services.

In a study of 11 towns throughout Germany (Brög and Erl, 2008), new rail lines were built to replace existing bus services (Erl, personal communication, June 15, 2010) in an attempt to improve the speed and reliability of PT in the regions. All improvements achieved increases of between 15 and 38 PT trips per person, per year for a combined ridership in all 11 towns totalling just over one million.

Davison and Knowles (2006) note that the key target of Quality Bus Partnerships (QBP)—to implement vehicle priority lanes—aims to improve the reliability of bus transport, as vehicles using those lanes are less subject to traffic congestion. In their assessment of QBPs in the Greater Manchester region, UK, increases in bus patronage were reported in all instances (from 7% to 50% over varying time periods of 12 months to 5 years).

Hensher et al. (2010) researched the effect of 40 new 'Superoute' bus lines in the town of Tyne and Wear, UK (population circa one million). A key focus of the study was on providing priority bus lanes and stops to enhance route punctuality. Results showed an increase in patronage of 40% over the first 2 years, continuing on an upward trend while other lines experienced stagnancy. The authors highlight that the improvement measures also focused on route frequency and vehicle comfort, so the increased ridership cannot be purely attributed to reliability.

3.2. Frequency

While in PT quality research frequency of service has been highlighted as a significant factor determining perceived service quality, it was only the fifth most commonly addressed attribute out of all seven attributes in the data analysed. As shown in Table 3, BRT and integrated PT services address most quality attributes simultaneously, and both address frequency.

In their study of 26 BRT cases worldwide, Levinson et al. (2003) agree that frequency is an often targeted quality attribute, with 75% of BRT programs aiming to offer frequent, all-day services. All cases showed ridership increases between 38% and 76%. Impressively, with daily ridership of over 40,000, the Los Angeles Metro Rapid bus service achieved increases of circa 30%—a third of which was generated by riders who had not previously used transit. In Vancouver with a weekday ridership of 26,000, 8000 new riders were added—20% of whom previously used automobiles, and 5% of whom were making new trips.

Two studies address frequency by considering the reduction of wait times between services on existing PT routes (Federal Transit Administration, 2010a,c), and they report increased ridership subsequent to the improvement. Notably, Wall and McDonald (2007) projected that increased frequency of a bus route in Winchester, UK (from four to six buses per hour) could boost ridership by approximately 20% in the first year even with a frequency elasticity of up to 0.4. Walker and Donovan (2007) found in their study of frequency improvements in 20 bus routes in Australian cities that patronage increased by 36% after 12 months, rising to just over 50% after 35 months, thus claiming evidence of persistent and sustained growth. This study focused on the weekday, inter-peak period of 9 am to 2 pm, as the authors claimed that the costs of increasing route frequencies are minimised during this period. The study has a duration long enough to isolate relevant patterns in the data. Despite the lack of specific information regarding the type and amount of the frequency increases for each of the routes, an average and persisting growth from 36% in patronage across 20 different routes in varied parts of Australia adequately demonstrates that frequency improvements in PT to encourage passenger response.

Table 3
Number of studies of public transport (PT) improvement strategies targeting different quality attributes.

Improvement strategy	Targeted quality attribute						
	Reliability	Frequency	Price	Speed	Access	Comfort	Convenience
Bus rapid transit (BRT)	15	13		16	1	15	8
Priority bus lanes		2		2			
Extended service		6			5		
Rail lines replacing bus	9			10			
Underground improvements	3			3			
Integrated public transport systems (quality bus partnership)	7	2	7	8	7	9	9
Price mechanism (discounts, free tickets, integrated ticketing)			14		1		5
Improved information							2
Reduced distance between PT nodes					2	2	

In contrast, Friman (2004) found that customer satisfaction declined after the frequency of a PT service was increased. She explains that this was due to disruptions during the implementation of the improvement, causing an increase in negative critical incidents among the customers. Over a longer period of time, as the service regains stability, one may see a reversion of satisfaction towards the positive. This study thus reinforces the issue of context in user quality perceptions of PT services, and it highlights the importance of clear planning and smooth implementation of PT service alteration to ensure minimum disruptions to passenger mobility.

3.3. Pricing

Pricing also features heavily in the improvement studies. The positive effects of adjusted fare prices are well-documented. Studies involve either a period of free PT fares, transferable ticketing or reduced ticket prices.

Webb et al. (2007) found that the introduction of a Senior Sunday (enabling Victorian Seniors to travel within metropolitan areas for free on Sundays) and a Sunday Saver offer (unlimited travel across metropolitan Melbourne on Sundays for a very low price) rapidly increased patronage and received a positive customer reaction. Perone and Volinski (2003) note in their study of free PT services offered in a medium-sized transit service in Austin, Texas, USA that the free fares encouraged a 75% increase of ridership. However, the free fares attracted a considerable amount of 'disruptive' riders, that is, riders that annoyed the regular PT users, thus paradoxically leading to previously paying users asking for charged fares to be reinstated. Here, attributes such as safety and comfort seemed to have more importance than free travel. De Witte et al. (2006) found that free travel had less impact on French and Flemish students' ridership in Brussels, Belgium; their PT travel neither increased nor decreased. It was found that the students' knowledge and perceptions of the city, its local areas and how to access them by different PT modes was more important in affecting their choice of modal use. Fujii and Kitamura (2003), Thøgersen (2009), and Thøgersen and Møller (2008) all conducted studies on the impact on private car users of a period of free PT travel. In all cases the free period succeeded in attracting car users to the PT service. While PT ridership declined after the free period expired, it remained higher than prior to the intervention. It was concluded that price promotions are effective in encouraging increased PT ridership. Free transfers in Haifa, Israel contributed to an increase in passenger trips by 7.7% (Sharaby and Shiftan, 2012). Thøgersen (2009) notes that it is imperative that attributes such as access and frequency of the PT service are not prohibitively limiting to the use of public transit. While fare price can support and encourage intentions to use PT, other quality attributes will determine whether such intentions are implemented and maintained.

A variety of PT pricing mechanisms attempt to combine price attributes with convenience, customer loyalty and service provider co-operation. These include integrated tariff systems, seasonal passes, transferrable passes and automated ticketing. Apart from one study noting failure due to poor management of the implementation process (Wilson, 1999), all studies reveal notable levels of success for PT pricing mechanisms in terms of increased ridership levels: 12% in the long-term (Abrate et al., 2009); modal shift from cars representing 10–20% of ridership in an estimated ridership population in the tens of thousands (Dargay and Pekkarinen, 1997); growth from 27.7 to 65.9 million trips per year over the years from 1983 to 1995 (FitzRoy and Smith, 1998, 1999); 50% increase in ridership over 5 years in Madrid, Spain (Matas, 2004); and substantial ridership increases compared to the previously non-integrated systems across five integrated transport pricing systems in Germany (Pucher and Kurth, 1995). All these studies stress that the amount of impact afforded by pricing mechanisms is determined to a great degree by other attributes of PT service quality such as access, frequency, and speed.

3.4. Speed

Speed is also critical in affecting customer satisfaction with the perceived quality of PT services. A rail service improvement reduced commuting time by 15 min each way between central New York stations and outlying areas (US Federal Transit Administration, 2010b). Ridership then increased by 24.5% over one year, representing an average increase of 2000 weekday passenger trips. The implementation of priority bus lanes in Seoul, Korea also aimed at improving the speed of PT in a city with high congestion due to private vehicle use (Pucher et al., 2005). The new lanes increased the average PT speeds from 11 km/h to 22 km/h. Month-by-month comparisons of total bus use before and after the reform indicate more than 700,000 additional bus passengers a day on a daily ridership average of approximately 4 million passengers, while metro use remained about constant. Pucher et al. (2005) concluded that central to the reforms was the introduction of an entirely new system of BRT routes, with fully separate median lanes for express buses. As a consequence, the average bus speeds became only slightly lower than average car speeds, and this was a success factor.

Considering the speed attribute in the sense of reduced waiting times, Pucher et al. (2005) noted in their study of the Los Angeles Metro Orange Line BRT system that a key objective in the design of the system was to minimise travel waiting times. While ridership on all modes in the region increased, the Orange Line experienced more than twice the level of increase of rail and almost three times the increase of buses. Furthermore, while not quite reaching their optimal planned travel time reductions, 85% of passengers surveyed reported a perceived reduction in travel time by switching to the Orange Line.

3.5. Access

Access has been targeted by rather many improvement strategies (e.g., Federal Transit Administration, 2010d, e; Vuk 2005), but relatively few of the reviewed studies addressed effects on access. Loader and Stanley (2009) examined ridership changes in Melbourne, Australia, where accessibility was improved by extending PT routes to the outer, lower-income suburbs and by providing weekend and evening PT services. Growth in ridership was high compared to historical records, particularly in the outer suburbs and compared to routes continuing to provide poor service. Sixty nine percent of Melbourne's bus users do not have a driving license and 73% do not have access to a car, but low accessibility with PT services otherwise forces car use on low-income households. Improved accessibility encouraged increased ridership and in some cases led to users selling their cars as PT services now fulfilled their mobility needs. Also, users had more freedom as they were less reliant on rides or could now access places previously out of reach. Loader and Stanley stressed that a minimum level of PT service quality must be provided before ridership levels increase.

Chien and Qin (2004) noted that a common determiner of accessibility in PT is the density and locations of PT nodes (bus stops) along routes. In their attempt to model the optimal number of PT nodes along a hypothetical three mile bus route, the authors found that the optimal number and locations of PT stops is chiefly affected not by route length, but by users' valuation of time, speed of accessing the node, and demand. While not focusing specifically on a PT improvement, a study on the value of accessibility of

a BRT system in Bogotà, Colombia (Rodriguez and Targa, 2004) found that properties located 5 min closer to BRT stations exhibit premiums between 6.8% and 9.3% in the asking rental price. This indicates that potential passengers value accessibility as an important quality in PT services, and that an increased access travel time of 5 min is significant for PT users.

3.6. Comfort

Transport suppliers often address the comfort attribute by providing improved standards for vehicles or stations. The introduction of a fleet of new, low-floor buses in one study (Wall and McDonald, 2007) aimed at improving comfort throughout the bus journey and making it easier to board and alight, particularly for disabled and aged individuals. While this improved level of comfort was highlighted by passengers as one of the most positive influences in using the service, it largely led to improved passenger service ratings rather than encouraging an increase in passenger numbers.

A project in Norwich, England (European Local Transport Information Service, 2010c) provided new, covered bus shelters with 15 seated spaces at the rail station and throughout the region's bus routes. An on-street survey subsequently found that 98% of respondents were at least satisfied (42% were very satisfied) with the quality of the new facilities. Researchers gave no indication as to whether the participants were new or existing PT patrons. While these results again shed light on the improvement's effect on passenger ratings, it is unclear whether such improvements in comfort can encourage increases in ridership.

In Foote's (2004) study of customer-focused improvements in the Chicago Transit Authority's PT services, results showed a 5% (or 15 million trips per annum) increase in ridership over 5 years after a sustained period of decline. Improvements focused on comfort-related issues such as vehicle cleanliness, safety and improved complaints handling. A subsequent survey of 2400 passengers revealed significantly increased satisfaction with regard to improvement in service quality, addressing vehicle crowding (7%), safety (6%), seat availability (5%), in-vehicle temperatures (5%) and ease of embarking the vehicle (3%).

3.7. Convenience

Convenience is defined here as how simple the PT service is to use and how well it adds to one's ease of mobility. While it relates closely to other PT quality attributes already discussed, it can be differentiated by considering the ease and simplicity of paying for and planning a PT trip. Therefore, introducing integrated ticketing systems is considered a key strategy aimed at improving convenience of PT services. In two studies of different PT systems, Matas (2004) and FitzRoy and Smith (1998) present evidence that the introduction of integrated ticketing systems can directly lead to increases in PT patronage. By replacing a complex per-boarding fare system with a simple zone fare system with free transfers in Haifa, 30% of the passengers reported that they were making more trips by bus after the reform (Sharaby and Shiftan, 2012).

Wilson (1999) outlines a two-stage introduction of fare integration and automated PT ticketing systems in Melbourne, Australia, explaining why one stage was successful, and one was less so. The first stage focused on fare integration, launching the 'Travelcard', the system's first multi-modal ticket, which allows passengers unlimited daily travel on all previously disconnected transport modes within the designated zone. While the Travelcard did actually entail an increase in travel price for passengers, the fare increase was met with little resistance as passengers largely perceived the Travelcard to have improved value as it offered potentially unlimited daily travel where, previously, passengers would need to buy a single ticket for each journey as well as whenever changing modes.

The second stage discussed by Wilson (1999) involved the implementation of the 'Met Card', which was an automated version of the Travelcard, designed to streamline the ticketing process without incurring additional costs to passengers. It was thus an attempt at ticket integration. The introduction phase of the Met Card was met with considerable criticism as it appeared to complicate a currently simple and convenient ticketing system. Wilson (1999) highlights the importance of passenger perception when implementing PT improvement measures. While the introduction of the Met Card did not objectively complicate the system, it was perceived by PT passengers to do so.

One study addressed convenience and ease of use through increased PT information provision for journey planning. Wall and McDonald (2007) found that this strategy did not have a significant impact on ridership numbers or passenger satisfaction. It was suggested that this is because information at travel points has little impact on a user's intended journey.

3.8. Effects on car use

The reviewed PT improvement studies generally indicate some level of effect, usually measured as increased PT passenger trips but sometimes as modal shifts from private vehicle use. Here we review the extent to which the improvement studies have resulted in modal shifts from private motor vehicles to PT.

Twenty out of the 74 studies addressed effects on private car use in their evaluation of PT improvements. As mentioned above, those studies conducted by Fujii and Kitamura (2003), Thøgersen (2009) and Thøgersen and Møller (2008) all found that free PT use has an initial effect in attracting car users to PT services, but that other quality attributes are important for sustaining this mode switch over time. In their development of an econometric model to ascertain whether PT price affects modal switch from private motor vehicle use, Sen et al. (2007) also reached the conclusion that while PT price can encourage car users to switch to PT, other quality attributes determine the duration of this effect. A survey of car users regarding their willingness to switch to PT found that increasing the cost of private vehicle travel had more influence than improving the speed of PT services (Fiorio and Percoco, 2007). This further affirms the importance of price in the attractiveness of PT services relative to private motor vehicles. The study also hints at a potential for change, as a significant proportion of people expressed willingness to consider mode switch. Dargay and Pekkarinen (1997) show that PT cost reductions as a result of integrated ticketing systems achieved a modal shift away from private car use of between 10% and 20%. This service improvement also enhanced access for the region, so price cannot be assumed to be the sole instigator for mode switch. A survey of car users' stated reasons for reduced car use for the work commute found that shorter travel time, increased frequency of service, and a lower fare would make PT more attractive to the car users (Eriksson et al., 2008).

Bell and Currie (2007) evaluated the impact of a new bus route introduced in a low-income, fringe-area of Melbourne, Australia. While no data on actual ridership are available, a post-implementation survey found 13% of users retrospectively stating that they chose to use the new bus routes over their private car, 20% were less reliant on others for rides, and improved access to leisure or activities was highlighted as a major outcome. Of non-users surveyed, the reason for not using the bus service was access to a private vehicle. Luk (2003) evaluated the impact of an extended and new rail service and related feeder bus routes in Perth and the Gold Coast, Australia. Results for Perth indicated 25% of new passengers previously travelled by car, and 11% had not previously used PT. The majority of new passengers (64%)

were considered new even though they had previously been using bus services that were replaced by the improvement concerned. Similar figures were found for the Gold Coast, and it is noted that in both cases car use in the same transport corridors was reduced by only a small percentage. In the Gold Coast, the initial drop in car use was only temporary; over time the up-trend in car use continued.

Another study addressed accessibility through improved PT servicing of a business complex employing approximately 21,000 staff in Portland, Oregon. The private vehicle mode share was reduced from 60% to 42% in the 10 years to 2007 (European Local Transport Information Service, 2010b). Other tactics such as parking restrictions, walking and cycling amenities plus employer subsidy and education campaigns were simultaneously implemented. The improved PT accessibility for this area therefore cannot be solely attributed for the car trip reductions.

While Fiorio and Percoco (2007), as mentioned, found that price is more important than PT speed in encouraging modal shift from private cars, an improvement in bus operations in Dublin, Ireland to increase speed and frequency resulted in a bus service that was about 6 min faster than if travelled by private vehicle (European Local Transport Information Service, 2010a). The improvement claims to have achieved a car mode share reduction from 34% to 22% as a result of the improvement. It is at this point where car users' perceptions become apparent as important influences in modal switch to PT.

Davison and Knowles (2006) argue that while their study of Quality Bus Partnerships showed evidence of increased ridership across multiple PT improvements aimed at frequency attributes, these figures do not reliably reflect real patronage growth because base figures are not provided, were calculated by internal sources, and there is no data offering information on whether patronage was affected in other PT modes. They conclude that the QBPs failed in effectively increasing patronage and reducing traffic congestion largely due to poor marketing and promotion of the services, leading to minimal awareness by potential users, coupled with the inability to change existing travel habits that were hinged on private vehicle use. This reinforces the important lesson that target groups are heterogeneous and that different information is needed to reach different groups.

In their study of car-using university students, Kerr et al. (2009) claimed that if car users believe that PT is a feasible and reasonable alternative to private transport, they are inclined to alter their travel accordingly. Likewise, Bamberg et al. (2003) aimed to affect decision processes and habitual travel by targeting individuals in the process of moving residential location. The results demonstrated a switch to public transport after the move interruption. Bamberg et al. (2003) conclude that in new decision contexts, car users may show a strong response even to small, relatively inexpensive interventions. This supports the notion of the impact of car user perceptions and intentions in affecting demand for PT.

The review also revealed 11 studies in which researchers implemented additional tactics to encourage a mode switch from private car use to PT. These include supply of free or discounted PT tickets, an event aimed at interrupting subjects' travel habits, and the provision of additional travel information material (Bamberg et al., 2003; De Witte et al., 2006; Fitzroy and Smith, 1998, 1999; Fujii et al., 2001; Fujii and Kitamura, 2003; Perone and Volinski, 2003; Thøgersen, 2009; Thøgersen and Møller, 2008; Wall and McDonald, 2007; Webb et al., 2007). Those studies implementing fare reductions or habit interruptions succeeded in achieving some initial shift from private car use to PT patronage. As mentioned above, a study assessing the effect of increased provision of travel information (Wall and McDonald, 2007) found that this did not have a significant impact on mode shift.

4. Discussion

Analysing studies of real-world PT improvements generally reveals that regardless of the attribute targeted, PT improvements tend to achieve some level of increase in ridership, customer satisfaction or modal shift away from private motor vehicles. The quality attributes addressed in the reviewed studies do not closely mirror those attributes considered most important in the research on PT quality attributes; price mechanisms featured heavily at the expense of reliability. The frequency attribute was still found in both the reviewed studies and the quality-attribute research to have a key influence on PT demand and satisfaction.

In using these findings to answer the question about which aspects of PT improvements potentially encourage a modal shift away from car use, the following four key points emerge.

First, PT service suppliers would benefit by acknowledging user-perceived attributes when approaching quality improvements. This would best be done by first understanding what quality attributes are important for the targeted car users, then planning how these can be best achieved by implementing PT improvements.

Second, both theory and empirical studies reveal that PT improvements are usually implemented before the quality attributes they potentially address are considered. Adjusting the planning and implementation process as suggested could enhance the general effectiveness of PT quality improvements on car-user demand for, and satisfaction with, PT services.

Third, the quality attributes of reliability and frequency are overall revealed to be of core importance in determining general PT demand and satisfaction levels. However, when considering the attractiveness of PT for car users, the important attributes become more complicated. It is most likely that car users will find PT attractive for attributes over and above basic mobility attributes, in as much as access to a car already provides these benefits. A basic level of access, reliability and competitive costs must be provided by PT services to meet that already offered by a private motor vehicle. Once this is achieved, more context-specific, perceived attributes of PT services should be provided, aimed at appealing to individual motivations and values of the target market. Furthermore, the benefits of these PT qualities must be communicated and demonstrated to car users to ensure that the service quality is perceived as such.

Fourth, there is evidence that access to a private motor vehicle is a key hindrance to an individual's demand for PT services. If aiming to attract private car users, it is important to determine or enhance the underlying motivations for using private vehicles and translate these into attributes that are emulated by PT services. The previous research reveals that tactics such as periodically free PT tickets and other interruptions of habitual car use are successful instigators to mode change as long as PT services have attributes that are perceived by the individual as at least equally appealing as travel by car. PT service providers are thus most likely to attract car users by providing promotional low-price ticket offers or creating events that break car-using habits to encourage car users to try PT services. Once car users sample the PT service, suppliers can sustain this modal switch by successfully providing—at a user-perceived level—those attributes the target market values as most important.

5. Conclusions

It is concluded that Public Transport (PT) services have the potential to attract private car users by improving the quality of the service. However, as pointed out above, exactly what improvements should be made depend chiefly on the context and particularities of

each targeted sample and individual motivations for using private motor vehicles. In some circumstances, improving accessibility may be enough, but in other circumstances where users are more emotionally attached to their private motor vehicles, other perceived quality aspects may need to be provided. Some segments (e.g., travellers who have access to a car but choose to use PT) in a specific area may be more sensitive to perceived attributes of PT service (less crowding, improved security, nicer stations and better user information, marketing and promotion) relative to physical attributes (higher speed, frequency and reliability).

Sustainable urban transport systems do not require complete eradication of private motor vehicles, but they must change the pattern of trade-offs among individual mobility, quality of life, environmental degradation and the undisputable convenience and emotional benefits that some individuals gain from private motor vehicle use. Encouraging modal shifts away from private cars to PT should always have the ultimate aim of contributing to a transport system (possibly comprising a variety of modes) that optimises temporal, price, environmental, social, and affective benefits and costs. Questions of sustainability are rarely solved with hard and fast answers, and more research and information are desirable. Discrete choice analyses may provide useful insight into understanding, and eventually influencing, travel mode choices. However, such analyses are only useful if user perspectives and values are first well-understood.

This study raises four issues that would benefit from further research. First, studies into the effect of improvements in the reliability of PT services would be a major contribution to this field of research. Second, more emphasis should be placed on perceived attributes when designing PT evaluation methods. Third, greater targeting of car users in future PT improvement studies would reveal more precisely what service attributes are attractive specifically to car users. And fourth, this field would benefit from more research into ways of enabling PT services to be perceived as having affective and symbolic value in addition to basic, instrumental worth. While examples from film and literature show that travel by bus or train can have symbolic and emotional connotations, there exists little evidence in research to suggest that PT could emulate those emotional and status-based qualities that some value so strongly in private cars. If it was possible for car users to establish emotional and symbolic connections with PT, they might be more likely to shift away from regularly opting to use their private cars. Yet, this is no small task.

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References

*Abrate, G., Piacenza, M., Vannoni, D., 2009. The impact of Integrated Tariff Systems on public transport demand: Evidence from Italy. Regional Science and Urban Economics 39 (2), 120–127.

Andreassen, T., 2005. (Dis)satisfaction with public service: the case of public transportation. Journal of Service Marketing 9 (5), 30–41.

Balcombe, R., Mackett, R., Paulley, N., Preston, J., Shires, J., Titheridge, H.,Wardman, M., White, P. 2004. The Demand for Public Transport: A Practical Guide, TRL Report TRL 593, Crowthorne, UK.

*Bamberg, S., Rölle, D., Weber, C., 2003. Does habitual car use not lead to more resistance to change of travel mode? Transportation 30 (1), 97–108.

Banister, D, 1996. Energy, quality of life and the environment: the role of transport. Transport Reviews 16 (1), 23–35.

Batterbury, S.P.J., 2003. Environmental activism and social networks: campaigning for bicycles and alternative transport in West London. Annals of the American Academy of Political and Social Science 590, 150–169.

*Bell, D., Currie, G. 2007. Travel and lifestyle impacts of new bus services in outer suburban Melbourne. In: 30th Australasian Transport Research Forum. Melbourne, Australia: Australasian Transport Research Forum. Available from: 〈http://www.patrec.org/web_docs/atrf/papers/2007/1586_Bell,Currie_Travel%20and%20Lifestyle%20Impacts%20of%20New%20Bus%20Services%20in%20Outer%20Suburban%20Melbourne.pdf〉.

Ben-Akiva, M., Boccara, B., 1995. Discrete choice models with latent choice sets. International Journal of Research in Marketing 12 (1), 9–24.

Boisvert, D., 1998. Switching to public transport. In: 22nd Australasian Transport Research Forum. Sydney, Australia: Australasian Transport Research Forum. Available from: 〈http://www.patrec.org/web_docs/atrf/papers/1998/Boisvert%20%281998%29.pdf〉.

*Brög, W., Erl, E. 2008. Global problems need global solutions: behaviour change in three continents. In: 4th International Symposium on Travel Demand Management. "Visions, Concepts and Experiences of Travel Demand Management". Vienna, Austria: SocialData.

Cantwell, M., Caulfield, B., O'Mahony, M., 2009. Examining the factors that impact public transport commuting satisfaction. Journal of Public Transportation 12 (2), 1–21.

*Chien, S.I., Qin, Q., 2004. Optimization of bus stop locations for improving transit accessibility. Transportation Planning and Technology 27 (3), 211–227.

Cooper, H., Hedges, L., 1994. The Handbook of Research Synthesis. Sage Publications, New York.

Cullinane, S., 2003. Attitudes of Hong Kong residents to cars and public transport: some policy implications. Transport Reviews 23 (1), 21–34.

*Dargay, J., Pekkarinen, S., 1997. Public transport pricing policy: empirical evidence of regional bus card systems in Finland. Transportation Research Record: Journal of the Transportation Research Board 1604 (1), 146–152.

*Davison, L.J., Knowles, R.D., 2006. Bus quality partnerships, modal shift and traffic decongestion. Journal of Transport Geography 14 (3), 177–194.

Dersin, P., Durand, J. 1995. Proceedings of 1995 Annual Reliability and Maintainability Symposium. Mass-transit system service quality—trade-off analysis on reliability, maintainability and logistics, pp. 515–528.

*De Witte, A., Macharis, C., Lannoy, P., Polain, C., Steenberghen, T., Van de Walle, S., 2006. The impact of "free" public transport: the case of Brussels. Transportation Research Part A 40 (8), 671–689.

Eboli, L., Mazzulla, G., 2008. A stated preference experiment for measuring service quality in public transport. Transportation Planning and Technology 31 (5), 509–523.

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

Eriksson, L., Friman, M., Gärling, T., 2008. Stated reasons for reducing work-commute by car. Transportation Research Part F 11 (6), 427–433.

*European Local Transport Information Service, 2010a. High-level bus service: the quality bus network—Malahide QBC. Available from: 〈http://www.eltis.org/study_sheet.phtml?study_id=2541&lang1=en〉 (accessed 19.03.10.).

*European Local Transport Information Service, 2010b. Lloyd district partnership plan in Portland, USA. Available from: 〈http://www.eltis.org/study_sheet.phtml?study_id=2517&lang1=en〉 (accessed 19.03.10.).

*European Local Transport Information Service, 2010c. Norwich Rail station interchange. Available from: 〈http://www.eltis.org/study_sheet.phtml?study_id=2623&lang1=en〉 (accessed 19.03.10.).

*Federal Transit Administration, 2010a. Innovative practices for increased ridership: Cambria County Transit Authority. United States Department of Transportation. Available at: 〈http://ftawebprod.fta.dot.gov/BPIR/BestPractices/BP-Search.aspx〉 (accessed 19.03.10.).

*Federal Transit Administration, 2010b. Innovative practices for increased ridership: capital area Transportation Authority. United States Department of Transportation. Available from: 〈http://ftawebprod.fta.dot.gov/BPIR/BestPractices/BP-Search.aspx〉 (accessed 19.03.10.).

*Federal Transit Administration, 2010c. Innovative practices for increased ridership: Greater Bridgeport Transit Authority. United States Department of Transportation. Available from: 〈http://ftawebprod.fta.dot.gov/BPIR/BestPractices/BP-Search.aspx〉 (accessed 19.03.10.).

*Federal Transit Administration, 2010d. Innovative practices for increased ridership: Montclair Connection. United States Department of Transportation. Available from: 〈http://ftawebprod.fta.dot.gov/BPIR/BestPractices/BP-Search.aspx〉 (accessed 19.03.10.).

*Federal Transit Administration, 2010e. Innovative practices for increased ridership: TransIT Services of Frederick County. United States Department of Transportation. Available from:〈http://ftawebprod.fta.dot.gov/BPIR/BestPractices/BP-Search.aspx〉 (accessed 19.03.10.).

Filipović, S., Tica, S., Živanović, P., Milovanović, B, 2009. Comparative analysis of the basic features of the expected and perceived quality of mass passenger public transport service in Belgrade. Transport 24 (4), 265–273.

*Fiorio, C., Percoco, M., 2007. Would you stick to using your car even if charged? Evidence from Trento, Italy. Transport Reviews 27 (5), 605–620.

*FitzRoy, F., Smith, I., 1998. Public transport demand in Freiburg: why did patronage double in a decade? Transport Policy 5 (3), 163–173.

*FitzRoy, F., Smith, I., 1999. Season tickets and the demand for public transport. KYKLOS 52 (2), 219–238.

Flade, A., 1990. Attitudes of men and women on public-transit and its use. Zeitschrift fur Experimentelle und Angewandte Psychologie 37 (2), 218–229.

*Foote, P.J., 2004. Making buses better in Chicago: strategic implementation of customer-derived performance measures from 1995–2001 . Transportation Research Record: Journal of the Transportation Research Board 1884, 18–26.

*Friman, M., 2004. Implementing quality improvements in public transport. Journal of Public Transportation 7 (4), 49–65.
Friman, M., Edvardsson, B., Gärling, T., 2001. Frequency of negative critical incidents and satisfaction with public transport services. I. Journal of Retailing and Consumer Services 8 (2), 95–104.
Fujii, S., Gärling, T., Kitamura, R., 2001. Changes in drivers' perceptions and use of public transport during a freeway closure: effects of temporary structural change on cooperation in a real-life social dilemma. Environment and Behavior 33 (6), 796–808.
*Fujii, S., Kitamura, R., 2003. What does a one-month free bus ticket do to habitual drivers? An experimental analysis of habit and attitude change. Transportation 30 (1), 81–95.
Gifford, R., Steg, L., 2007. The impact of automobile traffic on quality of life. In: Gärling, T., Steg, L. (Eds.), Threats From Car Traffic to the Quality of Urban Life: Problems, Causes, and Solutions. Elsevier, Amsterdam, pp. 33–51.
Greene, D.L., Wegener, M., 1997. Sustainable transport. Journal of Transport Geography 5 (3), 177–190.
*Hensher, D.A., Mulley, C., Yahja, N., 2010. Passenger experience with quality-enhanced bus service: the tyne and wear 'superoute' services. Transportation 37 (2), 239–256.
Hensher, D.A., Prioni, P., 2002. A service quality index for area-wide contract performance assessment. Journal of Transport Economics and Policy 36 (1), 93–113.
Hensher, D.A., Stopher, P., Bullock, P., 2003. Service quality - developing a service quality index in the provision of commercial bus contracts. Transportation Research Part A 37 (6), 499–517.
Holmgren, J., 2007. Meta-analysis of public transport demand. Transportation Research Part A 41 (10), 1021–1035.
Jakobsson Bergstad, C., Gamble, A., Hagman, O., Polk, M., Gärling, T., 2011. Affective-symbolic and instrumental-independence psychological motives mediating effects of socio-demographic variables on daily car use. Journal of Transport Geography 19 (1), 33–38.
Kennedy, C., Miller, E., Shalaby, A., Maclean, H., Coleman, J., 2005. The four pillars of sustainable urban transportation. Transport Reviews 25 (4), 393–414.
Kerr, A., Lennon, A., Watson, B., 2009. The call of the road: factors predicting students' car travelling intentions and behavior. Transportation 37 (1), 1–13.
*Levinson, H., Zimmerman, S., Clinger, J., Rutherford, S., Smith, R.L., Cracknell, J., Soberman, R., 2003. Bus Rapid Transit volume 1: case studies in bus rapid transit. Transport Cooperative Research Program Report 90. Washington D.C., USA.
Lipsey, M., Wilson, D., 2001. Practical Meta-Analysis . Sage, Thousand Oaks, CA.
*Loader, C., Stanley, J., 2009. Growing bus patronage and addressing transport disadvantage—the Melbourne experience. Transport Policy 16 (3), 106–114.
Loukopoulos, P., 2007. A classification of travel demand management measures. In: Gärling, T., Steg, L. (Eds.), Threats From Car Traffic to the Quality of Urban Life: Problems, Causes, and Solutions. Elsevier, Amsterdam, pp. 275–292.
*Luk, J., 2003. Reducing car travel in Australian cities: review report. Journal of Urban Planning and Development 129 (2), 84–96.
*Matas, A., 2004. Demand and revenue implications of an integrated public transport policy: the case of Madrid. Transport Reviews 24 (2), 195–217.
Parkan, C., 2002. Measuring the operational performance of a public transit company. International Journal of Operations and Production Management 22 (6), 693–720.
Paulley, N., Balcombe, R., Mackett, R., Titheridge, H., Preston, J., Wardman, M., Shires, J., White, P., 2006. The demand for public transport: the effects of fares, quality of service, income and car ownership. Transport Policy 13 (4), 295–306.
*Perone, J., Volinski, J., 2003. Fare, Free or Something in Between? University of South Florida, Tampa FL, USA.
*Pucher, J., Kim, M., Song, J., 2005. Public transport reforms in Seoul: innovations motivated by funding crisis. Journal of Public Transportation 8 (5), 41–62.
*Pucher, J., Kurth, S., 1995. Verkehrsverbund: the success of regional public transport in Germany, Austria and Switzerland. Transport Policy 2 (4), 279–291.
Richter, J., Friman, M., Gärling, T., 2010. Review of evaluations of soft transport policy measures. Transportation: Theory and Application 2 (1), 5–18.
Richter, J., Friman, M., Gärling, T., 2011. Soft transport policy measures: gaps of knowledge and research needs. International Journal of Sustainable Transportation 5 (1), 199–215.
Rietveld, P., Bruinsma, F.R., van Vuuren, D.J., 2001. Coping with unreliability in public transport chains: a case study for Netherlands. Transportation Research Part A 35 (6), 539–559.
Rietveld, P., 2005. Six reasons why supply oriented indicators systematically overestimate service quality in public transport. Transport Reviews 25 (3), 319–328.
*Rodriguez, D., Targa, F., 2004. Value of accessibility to bogoťa's bus rapid transit system. Transport Reviews 24 (5), 587–610.
*Sen, A.K., Tiwari, G., Upadhyay, V., 2007. Should bus commuting be subsidized for providing quality transport services?A case for Delhi. Sadhana 32 (4), 329–345.
*Sharaby, N., Shiftan, Y., 2012. The impact of fare integration on travel behavior and transit ridership. Transport Policy 21, 63–70.
Thevathasan, A., Balachandran, B., 2007. Customers' perceptions of metropolitan train services in Melbourne. In: 30th Australasian Transport Research Forum. Melbourne, Australia: Australasian Transport Research Forum. Available from: 〈http://www.patrec.org/web_docs/atrf/papers/2007/1584_Balachandran, Thevathasan_Customers%20Perceptions%20of%20Metropolitan%20Train%20Services%20in%20Melbourne.pdf〉.
*Thøgersen, J., 2009. Promoting public transport as a subscription service: effects of a free month travel card. Transport Policy 16 (6), 335–343.
*Thøgersen, J., Møller, B., 2008. Breaking car use habits: The effectiveness of a free one-month travelcard. Transportation 35 (3), 329–345.
Too, L., Earl, G., 2010. Public transport service quality and sustainable development: a community stakeholder perspective. Sustainable Development 18 (1), 51–61.
Tyrinopoulos, Y., Antoniou, C., 2008. Public transit user satisfaction: variability and policy implications. Transport Policy 15 (4), 260–272.
de Vet, H.C., de Bie, R.A., van der Heijden, G.J.M.G., Verhagen, A.P., Sijpkes, P., Knipschild, P.G., 1997. Systematic reviews on the basis of methodological criteria. Physiotherapy 83 (6), 284–289.
*Vuk, G., 2005. Transport impacts of the Copenhagen metro. Journal of Transport Geography 13 (3), 223–233.
*Walker, J., Donovan, S. 2007. How does patronage react to service frequency? Available at: 〈http://www.ozebus.com.au/ozebus/img/FrequencyStudy.pdf〉.
*Wall, G., McDonald, M., 2007. Improving bus service quality and information in Winchester. Transport Policy 14 (2), 165–179.
*Webb, A., Martin, S., Le-Nguyen, P., 2007. The sunday saver and seniors sunday pass—growing public transport patronage at reasonable cost. In: 30th Australasian Transport Research Forum. Melbourne, Australia: Australasian Transport Research Forum. Available from: 〈http://www.patrec.org/web_docs/atrf/papers/2007/1628_Le-Nguyen,Martin,Webb_The%20Sunday%20Saver%20and%20Seniors%20Sunday%20Pass%20-%20Growing%20Public%20Transport%20Patronage%20at%20Reasonable%20Cost.pdf〉.
*Wilson, D., 1999. Why did Travel Card work and Met Ticket fail? Lessons in the integration and implementation of transport systems. In: 23rd Australasian Transport Research Forum. Perth, Australia: Australasian Transport Research Forum. Available from: 〈http://www.patrec.org/web_docs/atrf/papers/1999/Wilson%20%281999%29.pdf〉.