Accessing Cars

Insights from international experience

Sally Cairns & Clare Harmer
December 2011

RAC Foundation

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Registered Charity No. 1002705

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Acknowledgements

We are very grateful to Christiane Just (SuperShuttle), Jonathan Guard and Taras Kennedy (Avego), Juliane Muehling and colleagues (car2go), Toby Poston (British Vehicle Rental and Leasing Association), Tim Dixon (Leeds City Council), Marcus Enoch (Loughborough University), Jillian Anable (University of Aberdeen), Phil Goodwin (University College London/University of the West of England), Jon Parker (Integrated Transport Planning Ltd), Marcus Jones (TRL), and Elizabeth Box and the rest of the client team at the RAC Foundation.

Disclaimer

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Executive Summary

In 2011, the RAC Foundation published a think piece (Cairns, 2011a) on alternatives to the most common way of accessing cars – namely, that of households owning the vehicles which they use. These alternatives included, for example, renting vehicles, getting a lift and taking a taxi. The study was based on UK experience of such initiatives. This further study extends that work to examine experience in North America, Europe and Australasia, focusing particularly on where schemes are succeeding, and what is making them successful.

Conventional **vehicle rental** is well established, and car clubs are becoming an increasingly global phenomenon. One estimate suggests that there are already 1.25 million members worldwide, with numbers rapidly growing. Meanwhile, there are two important developments. The first is the growth of city car-hire schemes, which are similar to car clubs but with important additional features such as the possibility of one-way rentals – with notable schemes including Daimler's car2go venture (operating in cities including Ulm and Hamburg in Germany; Austin in Texas, USA; and Vancouver in Canada); the French Autolib' scheme in Paris; and several schemes in Munich, Germany (including DriveNow, led by the BMW Group and Sixt AG). Second, there is increasing development of 'peer-to-peer' rental schemes (where people can rent cars from neighbours). Rental companies, car clubs and city car-hire schemes all seem to be early adopters of electric vehicles.

Many formal **lift- or ride-share** matching services exist in other countries. Meanwhile, there is considerable experience (particularly in the USA) with related initiatives including: high-occupancy vehicle (HOV) lanes; the informal accompanied development of 'slugging' (where drivers and passengers team up to mutually benefit from use of the HOV lanes); van pooling (where people car-share in larger groups of 5 to 15 people); and park-and-pool facilities (where parking is provided to enable sharers to meet up). It is notable that most of these initiatives tend to facilitate ride sharing for commuters with relatively long journeys. Meanwhile, dynamic ride sharing is a recent innovation – this is where mobile phone technology enables drivers and passengers to be matched up in real time, and for automated driver payments to take place (depending on the route shared). There are currently major dynamic ride-sharing pilots happening in Seattle and Bergen, run by the company Avego. It is notable that ride-sharing sites may increasingly become linked to social networking sites.

Use of conventional **taxis** is clearly well established, and a number of shared-taxi schemes exist, usually for one of three reasons: to fill a gap in transport provision, often in rural areas; to serve other forms of transport (notably to link with airports, ports, train stations, and bus services); or to provide a safe and convenient form of night transport. SuperShuttle – our case study in this area – caters for over 8 million passengers a year (mostly travelling to airports in the USA), whilst TreinTaxi provides a shared-taxi service to 38 stations in the Netherlands. Meanwhile, Brussels has introduced an innovative night-time shared-taxi scheme called Collecto.

In terms of what determines whether schemes, in whatever format, are successful, the following factors emerge:

- **Critical mass** – schemes generally need a sufficient volume of users to be viable. Shared-ownership and shared-taxi schemes tend to require a volume of usage throughout the day; ride-sharing solutions seem to work best for commuting trips (though with niche markets for major events and at universities). Though this is not always the case, both ride-sharing and shared-taxi schemes tend to be focused along corridors with high volumes of use, relatively long journeys, and journeys where one end is fixed whereas the other end involves a variety of disparate origins or destinations.
- **Public sector attitudes and policies** – a positive approach from policymakers, inclusion of schemes in policy documents, and a good understanding of schemes and their impacts by those making decisions were all quoted as being important. In particular, the view, expressed by some, that 'public transport = good, car = bad' was not seen as helpful.
- Practical assistance from local authorities, which included: support with **marketing**, providing schemes with **access** rights and appropriate **parking** provision (and enforcing those where necessary), and providing **pick-up/drop-off points**.
- **Regulation and taxation** – as applying to vehicles, insurance, charging, access and parking. In relation to taxis, the appropriate scale for regulation was also seen as an issue.

It was notable that there are a number of joint ventures between some of the schemes reported here. For example, Zimride and Zipcar provide a joint offering to enable people to both book cars and share lifts through one process. There are also numerous examples of schemes forming collaborative links with public transport. For example, LeasePlan in the Netherlands offers a 'Mobility Mixx' service, giving lease drivers a range of options. Numerous car clubs have positive arrangements in place with public transport providers.

In general, this appears to be a rapidly growing and evolving area of transport activity, with potential for considerable expansion, given appropriate support.

Future research priorities in this area could include:

- further critical evaluation and synthesis of the car club literature (given that there is now a considerable body of work in this area);
- a major area-based pilot of all of these initiatives, including the development of collaborative relationships between all of the providers, and with a public transport operator, accompanied by proper evaluation of impacts;
- small-scale experimentation with the use of pick-up points (potentially ranging from providing park-and-pool facilities at motorway service stations through to the designation of rendezvous points on busy city arterial roads), accompanied by a proper evaluation of impacts;
- more primary evaluation and independent verification of the impacts of individual schemes and initiatives (both in the UK and overseas);
- further discussions with those currently running schemes, similar to the case study approach adopted here; and
- more detailed consideration of the policy levers that affect schemes.

1. Introduction

In February 2011, the RAC Foundation published a think piece on alternative ways of accessing cars and encouraging more efficient car use, which involved an informal review of the national literature on the topic, and discussions with those involved in running some of the more innovative schemes in the UK (Cairns, 2011a). This study provides an extension of that work by examining international experience in North America, continental Europe and Australasia. Its aim was to investigate how significant such alternative models have become elsewhere; the different sorts of innovation that are occurring; and the existing evidence about their impacts on, and positioning within, transport policy – all with a view to improving understanding of the potential for such initiatives in the UK.

As in the previous review, this work was focused on the three topic areas of:

- **vehicle rental / drive-yourself solutions** – such as conventional vehicle rental; car clubs (where people rent vehicles parked in the neighbourhood); and other, more innovative forms of rental;
- **lift- or ride-sharing / drive-sharing solutions** – including informal car sharing, formal matching schemes, high-occupancy vehicle (HOV) lanes and shared-parking schemes; and
- **taxis / expert driver solutions** – specifically taxis, and shared-taxi schemes.

In relation to each of these topic areas, the main questions considered were:

- Where are alternative models of car ownership and use proving **feasible and realistic** – for how many people, for what types of people and in what circumstances?
- What is the evidence about the **social, economic and environmental consequences** of these alternative models of car ownership and use? How do these impacts vary with circumstances?
- What policy measures affect the **take-up** of alternative models of car ownership and use, and/or optimise the outcomes of their adoption?

This phase of work was particularly focused on the first and third questions – i.e. where are schemes proving workable, and what has made them successful?

2. Methodology

2.1 Literature search

The primary focus of this study was a literature review of readily available information on relevant schemes operating outside the UK. In undertaking the literature review, we searched the databases listed below:

- TRL Library Catalogue
- Eltis (European Local Transport Information Service)
- KonSULT (Knowledgebase on Sustainable Urban Land Use and Transport)
- VTPI (Victoria Transport Policy Institute)
- Science Direct

The search terms used when interrogating these databases included:

- Alternatives to car ownership
- Vehicle ownership
- Vehicle rental
- Car leasing
- Vehicle leasing
- Car club(s)
- Peer to peer
- Car share
- Car sharing
- Lift share
- Lift sharing
- Car pooling
- Van pooling
- Taxi(s)
- Shared taxi(s) scheme
- Shared taxi(s)
- Taxi sharing
- HOV
- High-occupancy vehicle lane
- High-occupancy vehicle
- Parking
- Shared parking
- Regulated parking
- Reserved parking
- Priority parking
- Preferential parking
- Parking for car sharers
- Parking for car clubs

Searches took place in June and July 2011. Throughout the search process, the focus was on empirical data about the scale and impacts of initiatives that are still in operation. Consequently, a considerable body of material relating to generic debate and smaller initiatives and/or initiatives which are no longer in operation was discounted. The literature was variable in nature. For example, as there are a large number of car clubs in operation, and a considerable body of related literature, it was necessary to focus on those with particular features (e.g. the largest, the longest established). In other cases, the amount of formal material available was very sparse. A considerable effort was spent on gleaning information from the relevant websites pertaining to particular initiatives, on the basis that this usually provided the most up-to-date information available. A full list of the sources consulted, grouped by initiative, is given in the reference section (together with a references index). In general, our perception is that, with some exceptions, there is relatively little study of this topic, and the coverage is patchy.

2.2 Case studies and consultation

In the second phase of the research, more detailed information was sought on three case studies, one from each of the main areas of the report. Specifically, more information was obtained via personal contact with representatives from the city car-hire scheme car2go; the dynamic lift-sharing service offered by Avego; and the shared-taxi scheme run by SuperShuttle. We are extremely grateful for their help.

These case studies were drawn from a list of approximately 30 initiatives that were considered in some detail in a first phase of this work. Details from the other initiatives are included throughout the report. Unfortunately, it was beyond the scope of the work to look at these initiatives in more detail, or to find contacts for each scheme in order to verify the details that we have included. Our opinion is that this activity would produce considerably more insights than would be available from a further literature search.

A draft version of the final report was then sent round to approximately 35 UK experts for comment. Feedback was received from seven commentators, and has been incorporated. Consultee comments are reported in the text where appropriate.

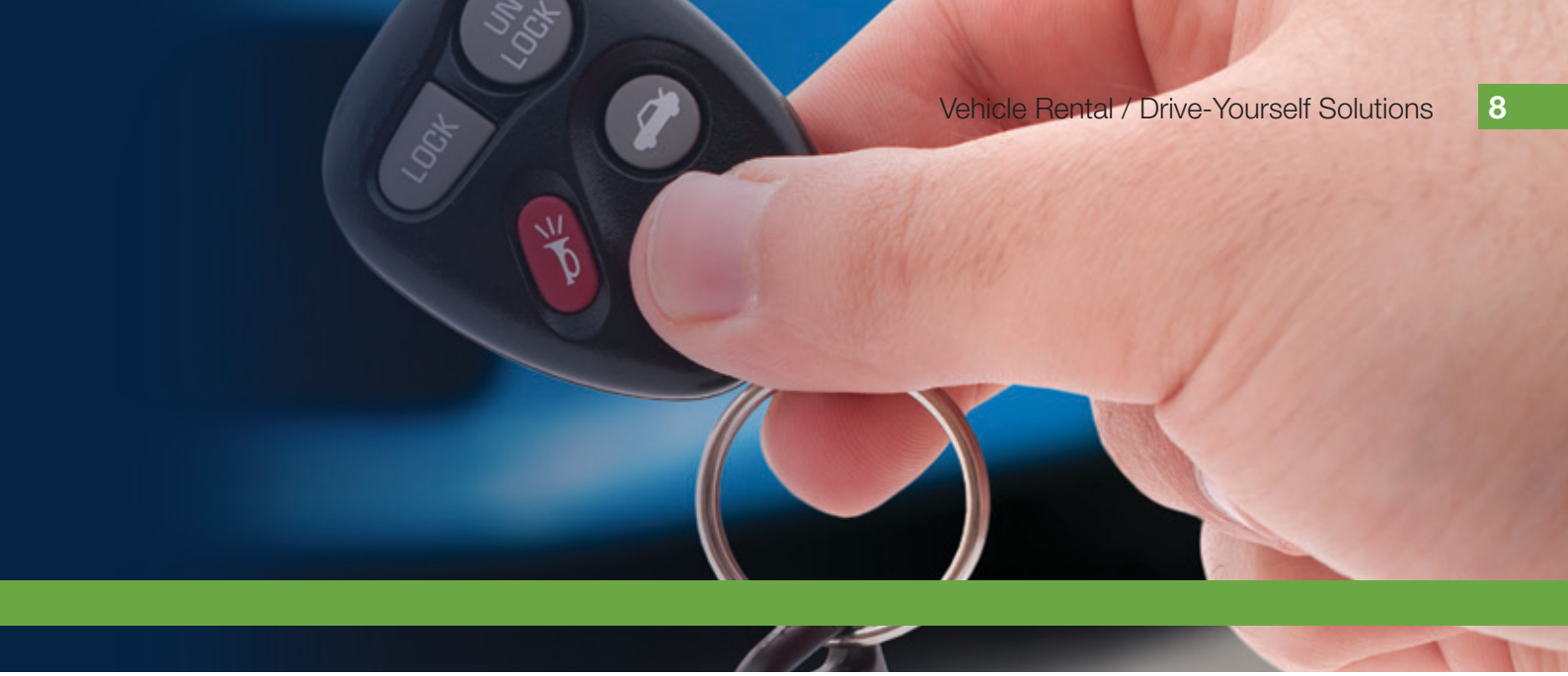
2.3 Features and limitations of the study

As already emphasised, this study is primarily based on a literature review, ranging from journal papers through to use of websites. It has not been possible to check with many of the information providers for accuracy, so information quoted here is only as reliable as its sources. Moreover, factual information is likely to be very much 'of its time' (i.e. June/July 2011), since this is a fast-moving field in which much is happening. The scope of the study has been limited to experience in North America, Europe and Australasia, excluding the UK. The budget did not allow for use of formal translation facilities, so obtaining information on European initiatives (and those in French-speaking Canada) has often meant using online translation facilities (including Google translate), which do not always provide unambiguous information. (This ambiguity is referred to in the text where necessary.) The schemes specifically referred to throughout the report were those that emerged through the literature search process. Given the relative lack of formal literature, it is entirely possible that important schemes have been missed. It is also the case that there will be very many similar initiatives that could have been mentioned, but which are not included, since this report was never intended to provide a comprehensive compendium of existing schemes – rather, the aim has been to identify the nature and features of the field more generally.

3. Vehicle Rental / Drive-Yourself Solutions

3.1 Summary of UK experience

In the previous RAC Foundation *Accessing Cars* report (Cairns, 2011a), we looked at four types of vehicle rental solution. The two main forms were conventional vehicle rental (with approximately 10 million 'rental acts' being undertaken from vehicle rental companies in the UK each year), and car clubs, which had approximately 161,000 members in January 2011, and which are growing fast (experiencing more than 40% growth between January 2010 and January 2011 alone). We also looked at WhipCar, a scheme to facilitate rental between neighbours (more formally known as 'peer-to-peer' rental), and Mu, a rental scheme offered by the vehicle manufacturer Peugeot, with links to the launch of its electric car, the iOn.



Evidence about impacts was most widely available for car clubs. The 2010/11 survey by Carplus (Harmer & Cairns, 2011) has generated data from 8,450 respondents and indicates that:

- 79% of members do not own a car; with a third reducing the number of cars in their household since joining (whilst only 4% increase the number);[1] 30% reporting that they would have bought a car had they not joined; and 61% reporting that they are less likely to buy a car in the future as a result of joining (with only 8% reporting that they are more likely to do so).
- On average, car club members make relatively frequent use of other modes – 66% of members report using a local bus at least once a week, 78% report making walking trips of 20 minutes or more at least once a week, and 32% report cycling at least once a week.
- On average, car club vehicles are about 26% more efficient than the average UK car in terms of CO_2 emissions.

Car club use per member is relatively low – in the order of 450 miles a year (or 635 miles a year if those who did not use the vehicles in the previous 12 months are excluded) – and 85% of households with car club members drive 5,000 miles or less a year. Data on the impacts on travel behaviour of conventional vehicle rental are more limited, though new evidence (Cairns, 2011b) suggests that rental vehicles are typically cleaner than the average British car, and relatively well maintained; that rental companies are leading in the use and distribution of lower carbon vehicles; and that they are often used to link with other forms of transport, including rail travel (with thetrainline.com now including a car-hire page). However, data is not available to assess how they affect overall travel choices.

1 One consultee commented that, of course, some changes in household car ownership would have happened anyway, since household car ownership is not static – see, for example, Goodwin (1988). This links to a bigger debate – namely, how does car club membership fit with broader decisions that people are making about their travel habits anyway, and to what extent does it act as a catalytic or causal factor? The survey data provides some insights into this issue, and broadly provides reassurance about a different concern that, for the majority of users, joining a car club does not seem to act as an incentive to become a car owner.

All forms of vehicle rental solution are likely to lead to higher levels of vehicle utilisation than is typical of conventional private cars (that is to say, the vehicles are likely to spend less time parked); and to offer a more affordable solution to occasional users than personal ownership.

3.2 Scale of international experience

3.2.1 Overview

Our exploration of the international literature has suggested that there is considerable evidence relating to car clubs (most commonly referred to as 'car-share schemes' outside the UK), with relatively little information about conventional vehicle rental, and some reporting on websites (but with little in the formal literature) about new solutions such as peer-to-peer rental, and city car-hire schemes. These new solutions are discussed in the next section, since they represent new developments in this area.

3.2.2 Conventional rental

Conventional rental is now organised on an international scale. For example, Avis and Hertz are worldwide brands. However, the nature of rental varies between places – in particular, for example, the relative balance between short- and long-term rental/leasing.

In relation to this study, we have come across one particularly interesting example: a service called Mobility Mixx offered by leasing company LeasePlan in the Netherlands. Alongside traditional fleet management, this allows lease drivers to use alternative modes of transport, offering a combination of opportunities for business travel in one package. Specifically, its Mobility card provides access to rental vehicles, pool cars, trains, buses, hire bikes, taxis and park-and-ride parking. It incorporates the OV-chipkaart (the Dutch public transport smart card). It also facilitates the electronic processing of mileage claims and the management of personal mobility budgets. The Mobility Mixx service also provides door-to-door travel advice via the Internet or call centres, allowing employees to choose and combine transport modes.

It is also notable that Hertz in the UK now offers an electric bike rental scheme from one of its London branches (Hertz, 2011).

3.2.3 Car clubs

3.2.3.1 Scale of activities

Enoch and Taylor (2006) report that prior to 1987, only small-scale car clubs were in existence. They identify the first major scheme as being the Mobility scheme in Switzerland, launched in 1987. Following the launch of Mobility,

they report, schemes spread to Germany, Austria and the Netherlands and then, following on from that, to the UK, Denmark, Italy, Sweden, Canada and the USA. Over time, rates of growth have been rapid – they report that in 2005, in Europe, there were more than a hundred car club schemes, with more than 120,000 members; in the USA, there were 15 car clubs, with 61,652 members (sharing 939 vehicles); and in Canada, there were 11 car clubs, with 10,759 members (sharing 528 vehicles).

Innovative Mobility Research (2011) have then provided an update of those statistics, with their figures indicating further rapid growth. They report that, as of October 2010, car clubs were operating in 26 countries, and planned in a further eight, across five continents, accounting for an estimated 1.25 million members sharing approximately 31,000 vehicles, of which about half were based in North America. Specifically, they report that, in North America, as of July 2011, 26 US car club programmes had 560,572 members, sharing 10,019 vehicles and 20 Canadian car club programmes had 78,840 members, sharing 2,605 vehicles.

Zhao (2010) estimates that rapid growth will continue, such that by 2016 car club membership will reach 4.4 million in North America and 5.5 million in Europe.

Evidence about individual clubs indicates that the oldest European club – Mobility, founded in 1987 – has about 96,800 customers in Switzerland, together with 10,500 members in a linked venture in Austria (DENZEL Mobility CarSharing GmbH). The oldest North American club – Communauto, founded (as a cooperative called Auto-Com) in Canada in 1994 – has approximately 23,000 members. The largest club in the world is Zipcar, founded in 2000. It is largely based in North America, though has a considerable UK presence. In total, it has around 560,000 members (of whom a considerable number are UK members). Schemes which operate in more than one country are becoming increasingly common – for example, *moses*[2] (2005) describes the setting up of the Belgian car club Optimobil via collaboration with the German operator Cambio, and reports that members from both countries can use vehicles in either country.

3.2.3.2 Car club impacts

There are a number of different reports about the impacts of car clubs, from both overview papers and reports associated with individual schemes (see, for example, some of the evidence reported for Mobility, Zipcar and Communauto). It has not been possible to critically review this evidence within the scope of this project. However, most findings are in line with those quoted in two overview papers by Shaheen and Cohen (2007) and Shaheen et al. (2009). These refer to at least 16 studies, quoting results which suggest that, averaged across all members, reductions in personal car ownership, reductions in vehicle kilometres travelled, and/or increases in walking, cycling and public transport use do result from joining a car club. Their main findings are summarised in Tables 3.1 and 3.2. These findings are also in line with the evidence for UK car clubs discussed in section 3.1.

Table 3.1: Car-sharing benefits by region

Region	Number of vehicles replaced by one car club vehicle	Participants who sold private vehicle after joining car club (%)	Participants who postponed or avoided vehicle purchase because of car club (%)	Reduction in vehicle kilometres because of car club (%)
Europe	4–10	15.6–34	23–26.2	28–45
North America	6–23	11–29	12–68	7.6–80*

Source: Shaheen & Cohen (2007)

** average of 44% across studies*

2 *moses,* 'Mobility Services for Urban Sustainability', was a European project focused on car clubs.

Table 3.2: Impacts of car clubs in North America

	Author(s) & year, as summarised in Shaheen, Cohen & Chung (2009)	No. of vehicles removed from the transport network per car club vehicle	Participants selling personal vehicle (%)	Participants avoiding vehicle purchase (%)	Change in vehicle miles/ vehicle km travelled (%)	Participants walking more (%)	Participants taking transit more (%)
US studies							
Short-term auto rental (San Francisco)	Walb & Loudon, 1986	–	15.4	43.1	–	–	–
Arlington car club pilot	Price & Hamilton, 2005	–	25	68	-40	54	54
Arlington car club	Price et al., 2006	–	29	71	-43	47	47
CarSharing Portland	Katzev, 1999	–	26	53	–	–	–
CarSharing Portland	Cooper et al., 2000	–	23	25	-7.6	25.8	13.5
City CarShare (Year 1) (San Francisco)	Cervero, 2003	–	2.5	60	-3*/-58 #	–	–
City CarShare (Year 2)	Cervero & Tsai, 2004	6.8	29.1	67.5	-47*/-73 #	–	–
City CarShare (Year 4)	Cervero et al., 2006	–	–	–	-67*/24 #	–	–
PhillyCarShare (Philadelphia)	Lane, 2005	10.8~	24.5	29.1	-42	–	–
TCRP Report (National)	Millard-Ball et al., 2005	–	–	–	-63	37	40
Zipcar (National)	Zipcar, 2005	20	32	39	-79.8	37	40
Canadian studies							
AutoShare (Toronto)	AutoShare, 2003	6–8	15	25	–	–	–
AutoShare (Toronto)	AutoShare, 2005	8–10	–	–	–	–	–
Communauto (Québec Province)	Communauto, 2000	9.1	21–29	55–61	–	–	–
Communauto	Communauto, 2006	4.6~	24	53	–	12–13	26–34

Source: Shaheen et al. (2009)
–: data not provided.
*: existing members' reduction in vehicle miles travelled / vehicle km travelled
#: only trial members' reduction in vehicle miles travelled / vehicle km travelled
~: vehicles removed by members who gave up a car

3.2.3.3 Support mechanisms

Enoch and Taylor (2006) provide a fairly comprehensive review of the different forms of support for car clubs (with their findings echoed in Clavet et al., 2009, and *moses*, 2005). In particular, the following factors are identified.

- Positive promotion of car clubs by the public sector, the creation of an umbrella organisation for them, the development of formal standards or definitions of car club operations, and their inclusion in policy documents

For example, in the Netherlands, the organisation 'Stichting voor Gedeeld Autogebruik' (founded 1995) and in Italy, the organisation 'Iniziativa Car Sharing' (founded 2000) have both played a similar role to the UK organisation Carplus in the promotion and regulation of car clubs, and have been supported by positive policy statements about the potential of car clubs to contribute to sustainable mobility. (However, the scale of the activities of these organisations may be somewhat different to that of Carplus, given substantially greater funding – for example, *moses* (2005) reports that the Italian Ministry of the Environment allocated €9.3 million for the promotion of car clubs in Italy in 2000.)

- Tax breaks, subsidies and funded marketing activity

For example, financial subsidy can include start-up grants to buy vehicles and technology; indirect subsidy (such as local authorities agreeing to use car club vehicles for business travel); or tax breaks. For example, in Oregon, tax credits became available in relation to car club parking following an energy conservation bill in 2001.

- Parking provision, on-street signing and changes to planning rules

Provision of appropriate parking is seen as one of the most important forms of local authority support for car clubs. Interestingly, Clavet et al. (2009) report on several French car clubs which have involved a parking provider, and which have developed relatively quickly as a result. (Specifically, they refer to the formation of car club Okigo in Paris (now 'Avis on Demand'), involving rental company Avis and parking manager Vinci; and the Lyon Parc Auto service in Lyon.) *moses* (2005) discusses the value of appropriate on-street signing for car club spaces, whilst Enoch and Taylor (2006) report on the designation of car club spaces in new housing developments, and reductions in the number of parking spaces required for new dwellings by planning requirements, sometimes with compensatory requirements for car club provision.

- Linking car clubs with the public transport options

Numerous examples of positive arrangements between car clubs and public transport providers are quoted. For example, in Hanover, public transport operator üstra and car club teil-Auto have positive reciprocal arrangements such that season ticket holders pay a reduced car club joining fee, and car club members can get reduced season tickets. The arrangements are reported to have increased car club membership and encouraged a number of season ticket holders to get rid of their car. In Bremen, those purchasing an annual season ticket get a single smartcard which also allows access to the Cambio car club at a preferential rate. *moses* (2005) reports on 1,000 users of the combined offer, and a shift in purchasing from monthly season tickets to annual season tickets, with financial benefits for the public transport operator.

3.3 Significant trends and developments

This section reviews significant trends and developments that appear to be emerging in relation to vehicle rental solutions.

3.3.1 Use of lower carbon vehicles

First, it seems clear that conventional rental and car clubs have the potential to lead the way in adopting new kinds of vehicle technology.

As reported in Cairns (2011b), in the UK, a number of rental organisations have some kind of 'green' car group, and include various low-emission vehicles as part of their fleet. Avis, Europcar, Hertz and Enterprise all have orders or trials of electric vehicles, with a spokesperson for Renault arguing that the adoption of electric vehicles by the rental companies will help to drive wider market adoption. Several companies are involved in initiatives such as the Plugged-In Places scheme in London. There are also various reports of rental companies adopting electric vehicles abroad, and Gallucci (2011) argues that the speed of

electric car take-up in the USA will depend upon their adoption by large fleet operators, which would include the rental companies.

Car clubs are also starting to adopt electric vehicles, with Zhao (2010) forecasting that electric vehicles will be increasingly leveraged by the car-sharing programmes after 2012, such that, by 2016, worldwide, one in every five new shared vehicles, and one in ten of all shared vehicles, may be an electric vehicle.

In our review of the evidence, we came across a number of specific examples, as follows:

- Greenwheels (a car club company operating in the Netherlands) has been piloting the introduction of electric vehicles into their fleet at 25 locations, across four cities, including Amsterdam, Rotterdam, Utrecht and The Hague.
- Mobility supported a project called Alpmobil between July and September 2010, which provided 60 electric vehicles at stations in the regions of Haslital and Goms. The cars had a range of 120 km and could be hired for CHF60 per day.
- Communauto announced in April 2011 that it will introduce 50 electric vehicles (Nissan Leafs) into its fleet in the summer of 2011.
- Zipcar introduced eight Toyota Prius Plug-in Hybrids in January 2011 in Boston and Cambridge, Massachusetts (three cars); San Francisco, California (three cars); and Portland, Oregon (two cars).
- Zen Car in Brussels is a new scheme involving 29 electric cars distributed across 15 sites, which was launched in March. (It is unclear whether this is a conventional car club, or a city car-hire scheme of the kind defined and discussed in section 3.3.2.)
- Nice-Côte d'Azur launched an 'Auto Bleue' car club in April with 51 electric cars and 17 stations. There are plans for this to expand to 210 electric cars spread across 70 stations, supported by major public investment.

It is also notable that the city car-hire schemes reported below are making use of electric vehicles. This is part of the raison d'être of the Paris scheme, and car2go is involved in a major trial of electric vehicles in Amsterdam (and, in the near future, San Diego).

3.3.2 City car-hire models

There has been considerable recent investment in city car-hire schemes, with the first major scheme being the launch of car2go in Germany in 2009. More detail on schemes is given below, and the car2go model is featured as a case study at the end of Section 3. The distinction between a city car-hire scheme and a car club is not clear-cut, but is currently defined on the basis of whether users need to return a vehicle to its collection point, and therefore whether one-way rentals are possible.

3.3.2.1 Autolib'

Autolib' is the proposed Paris scheme. It will involve a fleet of 3,000 self-service electric vehicles that can be picked up and dropped off at 1,000 rental stands around the city (700 of which will be in the city centre and 300 in the main surrounding towns such as Boulogne-Billancourt, Nanterre and Issy-les-Moulineaux). Each rental stand will have recharging posts to charge the electric batteries. The scheme will use Bolloré's Bluecar, which has a range of 250 km (155 miles) in between charges, which take about four hours. One estimate suggests that each car will replace five to ten private vehicles, though it is unclear how this statistic has been derived. A small-scale version of the scheme, with 11 cars, has been in place since 2007 in the city of Antibes on the French Riviera.

3.3.2.2 car2go

car2go is a subsidiary of Daimler AG. It provides a fleet of cars which are available for rent throughout a designated operating area and can either be accessed on demand or booked shortly before use. Members may use a vehicle for as long as they like, without committing to a specific return time or return location. The scheme uses distinctive, specially developed cars – specifically, a car2go edition of Daimler's smart fortwo micro-hybrid drive vehicle. To date, car2go has been successfully launched in four cities, and two further schemes are to be launched before the end of 2011. Feasibility assessments are being undertaken for other major European and North American cities. A summary of announced car2go schemes is given in Table 3.3.

Table 3.3: car2go schemes

Location	Launch date	Scale
Ulm (Germany)	March 2009	300 cars; >22,000 members
Austin (Texas, USA)	May 2010 (following pilot)	300 cars; >15,000 members
Hamburg (Germany)	April 2011	300 cars; >5,000 members
Vancouver (Canada)	June 2011	225 cars
Amsterdam (Netherlands)	Before end 2011	300 cars (all electric vehicles)
San Diego (California)	Before end 2011	300 cars (all electric vehicles)

Source: Personal correspondence with car2go, July 2011

3.3.2.3 DriveNow

DriveNow is a joint venture between the BMW Group and the car rental company Sixt AG. It was launched in Munich in June 2011, and its launch in

Berlin is planned in the near future. The scheme uses four-seater premium BMW 1 Series and MINI cars. The initial plan was for 300 vehicles in Munich and 500 vehicles in Berlin. One interesting feature of the scheme is the inclusion of 18- to 21-year-old drivers, provided they have successfully completed an approved driver safety training course. (Some UK car clubs restrict membership of schemes by younger drivers.) Use of electric vehicles is reported to be planned for the future.

3.3.2.4 ZebraMobil

ZebraMobil also operates in Munich. It is an independent company, working in partnership with public transport authority MVG. It was launched in April 2011, with 10 cars, with the number increasing to 30 in July. There are plans to increase the fleet size to 200 vehicles within two years. The scheme offers a combination of Audi A1 and A3 cars.

3.3.3 Emergence of peer-to-peer models

A second major trend is the emergence of a growing number of peer-to-peer, or neighbour-to-neighbour, car rental schemes. These are currently the subject of doctoral research (by Rafaela Arriaga at MIT). Table 3.4 gives examples of the main peer-to-peer schemes we have identified during this review.

Table 3.4: Various peer-to-peer rental schemes (as of July 2011)

Scheme	Location	Scale
RelayRides (2008 launch)	Boston and San Francisco (USA)	June 2010 trial in Massachusetts seeing 50 participants renting cars to 1,000 borrowers
Getaround (still in trial)	San Francisco and San Diego (USA)	Not available
SprideShare (September 2010 pilot)	San Francisco (USA) (coming to Oregon)	Linked car club has 13,000 members
DriveMyCar Rentals (December 2008 launch)	Australia (with Europe/ US expansion planned this year)	As of November 2010, >5,000 vehicles and 8,000 registered users
RentMyCar (May 2001 launch)	Konstanz (Germany)	800 vehicles offered in first two years
tamyca (November 2010 launch)	Germany	Not available
Livop (November 2010 launch)	France	In three months, scheme attracted 100 owners and 350 drivers

Source: Authors' own

At present the schemes do not operate in the same way, and include various interesting features which are outlined below.

3.3.3.1 Insurance

All of the schemes identified offer both car owners and drivers full insurance cover (although DriveMyCar introduced an insurance product only in 2010, after a successful launch in 2008 without it). In the USA, the schemes in California have benefited from the changes to car insurance arrangements in Assembly Bill 1871, which have made it easier for individual cars to be used in sharing schemes.

3.3.3.2 Pricing

Each of the schemes identified have taken different approaches in terms of pricing.

Although most offer both owners and drivers free membership, there are exceptions. For example, Livop charges drivers a €50 annual subscription fee, while DriveMyCar Rentals (DMCR) charges owners AUS$25 per year for listing their car.

The schemes also take different approaches in relation to deciding how much owners charge for the use of their car. For example, RelayRides allows owners to set their own price, of which 15% goes to RelayRides, 20% covers the insurance premium and the rest (65%) goes to the owner, minus fuel costs (which are borne by the owner). In contrast, Livop determines the rental charges based on the age and model of the vehicle.

There are also variations in terms of what is included in the prices charged to drivers. For example, some schemes offer an all-inclusive price, including insurance, fuel and roadside assistance (e.g. RelayRides), while others do not include fuel, requiring this to be paid for separately (e.g. Getaround). Unfortunately, it is not possible to assess how the pricing strategy affects take-up.

3.3.3.3 Car access arrangement

At present, there appear to be three different arrangements for accessing the cars involved in the schemes. The most common approach appears to be installing a device in the cars which allows access using a smartcard; keys are then found inside the car. This means that owners and drivers do not need to arrange a key swap. The devices placed in the cars can also be used to track mileages and to locate the vehicle. Installation of these boxes requires a technician, and it appears that they are usually provided and fitted free of charge. There are indications, however, that this may not be the case in the future. For example, RelayRides states that it is currently waiving a US$250 set-up fee.

Another similar approach, being used by Getaround, involves installing a device which allows access via smartphone. At present this is restricted to those with an iPhone, although an Android app is planned. However, using this method is not a requirement, and users can arrange key swaps instead.

The final approach does not involve installing technology, instead relying on owners and drivers to arrange and undertake key swaps. This method is currently used by DMCR.

3.3.3.4 Links with social networking

The majority of the schemes identified in the review have links to the social networking sites Facebook and Twitter. As of 21 July 2011, on Facebook the identified schemes pages had from 195 to 1,012 'likes' each, and on Twitter had between 44 and 1,874 followers. (In the UK, WhipCar has a Facebook page, with 327 'likes' as of 10 June 2011 – Hutchins & Binsted, 2012.)

3.3.3.5 Other interesting features

- RelayRides is a start-up backed by Google Inc.'s venture arm.
- SprideShare links with the car club City CarShare, thereby providing a large pool of already screened members.
- DMCR is also linked with a more conventional leasing service, and offers, in addition, a premium service called Manage My Car for people who are going away, or who do not want to manage the rental process themselves.
- RentMyCar provides users with a Virtual Vehicle Inspection Sticker, and has a business method using neighbourhood 'rent my car' managers.

3.4 car2go case study

This case study is based on a combination of information from published sources, as listed in the references, and information from Juliane Muehling, Corporate Communications Manager, car2go, and her colleagues, July 2011.

3.4.1 Scheme overview

car2go is a subsidiary of Daimler AG. The scheme provides a fleet of cars which are available for rent throughout a designated operating area and can either be accessed on demand or booked shortly before use. The vehicles can be parked on public or specially marked private parking spaces, without the necessity for dedicated public bays.

Vehicles are distributed randomly over the operating area. Registered members can find the location of cars on the Internet, with the help of a smartphone app or by walking around. Members may use a vehicle for as long as they like, without committing to a specific return time or return location. The driver can

finish the rental in any available legal public parking space within the operating area, or at a specially marked car2go space in a private parking facility. Marked spaces are usually in off-road locations – often being designated, for example, in unused spaces in car parks. The availability of public parking to car2go members may vary, depending on the arrangement made with the city involved, but can, where necessary, include both pay-and-display spaces, and controlled residential parking zones.

Rental charges are based on minutes used, and include fuel, insurance, parking, breakdown cover and maintenance. Hourly tariffs apply if cheaper for the member. There is a one-time registration fee, with no deposit or long-term contract, or annual membership renewal. So far, car2go schemes in operation are open to anyone with a driving licence – including younger drivers, who, in the UK, can be excluded from conventional car clubs.

The car2go scheme uses a distinctive and specially developed car2go edition of Daimler's smart fortwo micro-hybrid drive (mhd) vehicle, with stop-start technology to eliminate unnecessary engine idling whilst stationary, and with average tailpipe emissions of just 98 gCO_2/km. Pure electric versions with zero tailpipe emissions are also being deployed where local circumstances permit (see section 3.4.5) The cars need approximately half the parking space of a conventional car. Moreover, they use a specially designed telematics system for booking and operations that has been developed by car2go and is integrated with the vehicle electronics. The key features of the scheme which distinguish it from a conventional car club, as identified by car2go, are:

- open-end rentals – users do not need to reserve a vehicle in advance or commit to a usage or return time;
- one-way trips – users do not need to bring the car2go vehicle back to where it was picked up, or park it in a specifically designated space (thereby negating the requirement of the local authority to invest in designated bay 'lines & signs');
- pay-as-you-go pricing – users do not need to commit to a long-term contract, minimum spend, deposit, or ongoing membership fees; and
- a strong brand and a clear brand identity.

Photo courtesy of car2go GmbH

3.4.2 Details of specific schemes

As of July 2011, car2go had been successfully launched in four cities in Europe and North America, and the service is set to expand. At least two further schemes are to be launched before the end of 2011. Feasibility assessments are being undertaken for other major European and North American cities. The UK market is receiving extensive consideration, and feasibility assessments are being undertaken for key cities with significant population sizes and densities. Details of schemes that are in operation, or about to be launched, are as follows.

Scheme 1: Ulm, Germany

The service was first piloted in Ulm in March 2009, when 200 cars were distributed across the city. The purpose of the pilot was to test the functioning of the technology and the acceptance of the service by customers. The fleet now comprises 300 vehicles and there are more than 22,000 registered members, of whom 10,000 joined in the first three months of operation. This accounts for over 10% of the population of Ulm and nearly 20% of driving licence holders. Of the users, about 60% are less than thirty-five years old. Since launch, there have been more than 550,000 rentals.

Scheme 2: Austin, Texas, USA

In November 2009, car2go's second pilot began in Austin, aimed at testing the internationalised version of the technology. Initially, the 200 cars distributed in the downtown area were for use by employees of the city. In May 2010 the service was opened to the general public, and in March 2011 the fleet size increased to 300 vehicles. There are now more than 15,000 registered members, and more than 200,000 rentals have taken place in a business area of 135 km^2.

Scheme 3: Hamburg, Germany

The next German phase of car2go was launched in Hamburg in April 2011, with 300 vehicles being made available over an area of 65 km^2 in the centre of the city. The profile of Hamburg is considerably different to that of Ulm, and the comparative performance of the two schemes is being monitored. For example, Hamburg is felt to have a younger professional demographic profile and a significantly higher population density. After the first 100 days, there were more than 5,000 registered members and more than 40,000 rentals, and numbers are growing rapidly.

Scheme 4: Vancouver, Canada

car2go was launched in Vancouver in June 2011, following trials in the autumn of 2010. There are 225 cars available in the operating area of 47 km^2. car2go has experienced a strongly growing membership, even though the city already had an established structure of car club providers.

Scheme 5: Amsterdam, The Netherlands

car2go will be launching its first European all-electric service in Amsterdam, with a fleet of 300 smart fortwo electric drive vehicles being introduced before the end of 2011. By the end of 2011, the City of Amsterdam will provide 300 electric charging stations for electric car users, rising to 1,000 by the end of 2012.

Scheme 6: San Diego, California, USA

car2go will be launching the first North American all-electric car-sharing service in San Diego, involving another fleet of 300 electric vehicles. The scheme launch is planned before the end of 2011.

3.4.3 Evidence about impacts

Aside from related evidence about car clubs, there are currently two main forms of evidence about the impacts of car2go – surveys of users undertaken by car2go, and some independent research undertaken by the University of Ulm (Firnkorn & Müller, 2011). Further research is currently being undertaken by the Free and Hanseatic City of Hamburg in relation to the Hamburg scheme, and first results should be available by the end of 2011.

car2go undertakes quarterly surveys of 100–200 users of their scheme in Ulm. So far, these results suggest that:

- more than 75% of use is spontaneous (i.e. without prior reservation);
- 90% of rentals do not end at the point at which they started (although several consultees noted that a return journey involving a non-trivial activity in the middle would presumably be booked as two separate trips, making it difficult to assess the number of movements that are truly one-way);
- more than 94% of the users would recommend the service to family and friends.

In addition, car2go's operational data indicate that they have not experienced problems with vehicle clustering.

Firnkorn and Müller (2011) report on survey work with pedestrians in the centre of Ulm undertaken in June/July 2009, which resulted in 308 questionnaires completed by respondents who lived in Ulm, held a valid driving licence, and were not already members of car2go. A dramatic 83% of those surveyed reported that they expected to start using car2go. The population of those surveyed who did expect to start using car2go was distinguished from those who did not in three respects: it included a higher proportion of men, of those from younger age groups, and of those who were relatively highly educated. Using a combination of survey data and modelling techniques, Firnkorn and Müller also estimate that the adoption of car2go is likely to result in overall reductions in CO_2 emitted from people's personal transportation, though they emphasised that data from modelling are inevitably limited, and '*the forecast should not be overrated until validated by a triangulation with retrospective data*'. They also emphasised the speed and scale of take-up of car2go, compared with typical data for traditional car clubs. Moreover, given the socio-demographic characteristics of Ulm (reported as being a relatively conservative population with entrenched car ownership behaviours), these figures were felt to give a minimum indication of impacts. Firnkorn and Müller are working on a follow-up study.

3.4.4 Interaction with other transport providers

car2go sees itself as providing an intra-modal alternative for urban mobility, and not as a competitor to existing public transport. It states that it aims to serve as a niche offer, complementing public transport, bike-sharing programmes, taxis, rental cars and traditional car clubs. There are particular trip purposes where combined use might be sensible. For example, someone might choose to reach the supermarket via public transport, but travel home in a car2go vehicle with their shopping. Furthermore, car2go aims to bridge the gap commonly associated with the first and last mile of public transit usage.

In support of this approach, it is notable that in Ulm, the local public transport provider Stadtwerke Ulm/Neu-Ulm GmbH (SWU) has observed that passenger numbers have not decreased since the introduction of the car2go scheme. Indeed, car2go has a specific partnership with SWU. For example, students buying particular passes receive ten free minutes with car2go per week, and there are car2go bays at bus stations.

In Hamburg, car2go has a formal joint venture in place with the rental company Europcar. The unique nature of the car2go business model (a two-seat car, charged by the minute, and used predominantly for one-way trips) means that other car-based mobility options (such as traditional vehicle rental) are likely to remain attractive for particular trips. Thus, in Hamburg, Europcar offers preferred rates for car2go customers, aiming to offer a range of options that provide a complete alternative to owning a private car.

3.4.5 Preconditions for success

Criteria for success are defined in various ways. First, car2go requires urban populations of significant scale and density for high fleet utilisation. Second, it requires that the main movements within the area are not solely for commuting, but encompass a range of journey purposes, to ensure that vehicles are used throughout the day by a variety of members. Areas with a mixture of uses (such as university, business, residential and shopping) are thus the priority for future schemes. Third, car2go requires a city administration and strategic transport planning authority which embrace a policy direction that encourages intra-modal shift ('many private cars to fewer public cars' in the city) as a means to leveraging transport and environmental policy objectives. Parking arrangements are another key criterion. For the electric-vehicle version of the car2go scheme, a certain density of publicly available charging points is required.

4. Lift-Sharing / Drive-Sharing Solutions

4.1 Summary of UK experience

This section looks at people sharing cars for particular journeys – usually referred to as 'lift-sharing' or 'ride-sharing' in the overseas literature. Informal sharing has always taken place, ranging from lift giving between family members, to hitch-hiking. According to the 2008 National Travel Survey (DfT, 2009), 23% of trips and 29% of distance travelled is undertaken as a car passenger. Meanwhile, there are a number of different initiatives which have aimed to encourage car sharing more formally.

Direct services encouraging people to share include national (and international) journey-matching services; schemes run at a local or regional level to encourage people in the same locality to share; and schemes run by employers or schools to match up their employees or pupils. In the UK, scheme-provider *lift*share had nearly 440,000 members registered as of 10 June 2011. Formal schemes in the UK seem particularly effective for encouraging shared commuting, with a number of workplaces reporting the involvement of 20–30% of their staff (as reported in Cairns 2011a).

There are also several types of initiatives that aim to encourage sharing by providing preferential conditions for sharers. Of these, high-occupancy vehicle (HOV) lanes are predominant. There were eight HOV lanes in the UK at the time of the research (three in Leeds, two near Bristol, one in Birmingham, and one on the M606/M62 near Bradford). Another option is the provision of shared parking. Milton Keynes has an innovative scheme operating across its central area, giving parking privileges for those who have shared their journey. South Gloucestershire ran a 'park-and-share' site as a pilot, to encourage trip consolidation along a key route, but this was not considered to be successful.

In terms of impacts, it seems clear that if a shared journey replaces two single-occupancy car trips, there will usually be environmental benefits. However, in practice, the impacts on travel behaviour may be more complex. Two reports (from *lift*share, 2010, and ITP, 2004) indicated that, for some groups and/or locations, replacing single-occupancy trips may be the dominant effect, whilst in others, it may not. This requires further exploration, as available data is limited.

It is also notable that both the Leeds HOV lane and Milton Keynes parking scheme evaluations report on increases in bus use associated with their schemes (though one consultee highlights that, for HOV lanes, this is likely to occur only where the HOV lane effectively also introduces a bus lane). Social benefits – such as reduced social exclusion in rural areas, increased community cohesion, and improvements in quality of life for participants – are also quoted as benefits of such schemes.

4.2 Scale of international experience

4.2.1 Overview

The literature on ride sharing is mixed. Whilst there is some overview literature (see, for example, Chan & Shaheen, 2011), much of it is focused on particular types of scheme. There is relatively little available about the effects of matching schemes, and much of what can be found is relatively old and, for the most part, focused on evidence about schemes run at workplaces. However, in terms of actual schemes, there is clearly a growing body of experience, as outlined below. Meanwhile, there is slightly more literature relating to HOV lanes, to the associated development of informal car pools ('slugging'), to van pooling and to shared-parking arrangements. Each of these topics is now discussed in turn, followed by a consideration of two new developments in the field – dynamic ride sharing and the use of social networking sites.

4.2.2 Matching schemes

*lift*share is one of the world's largest car-sharing services, though there are also significant companies in other parts of Europe – notably Germany (Mitfahrzentrale, launched in 1998), Spain (Comuto, launched in 2009) and France (Covoiturage, launched in 2004). The Covoiturage scheme is of particular interest, since its website reports that it had 1 million users by April 2011, though there is little further relevant data readily available.

Meanwhile, it is also clear that car sharing is a growing phenomenon in the USA. Chan and Shaheen (2011) estimate that, as of July 2010, there were 613 ride-matching services in North America (361 in the USA, 229 in Canada and 23 spanning both). Two particularly large organisations (with an international reach but a US focus) are:

- PickupPal, launched in 2008, which had 154,885 members as of 19 May 2011. It reports that it is used in 119 countries, and by organisations such as Nike, Virgin, USA Triathlon and Live Nation.
- Zimride, launched in 2007, which reports that it has over 300,000 users. It focuses on developing ride-sharing communities in universities (e.g. California, Cornell and Stanford) and with corporate clients (e.g. Walmart, Whistler Blackcomb Ski Resort). It has links to the car club Zipcar.

NuRide (with 65,027 members as of 26 September 2011) is identified by Chan and Shaheen as representing a new development in car sharing. Whilst offering a trip-matching service, the website also enables members to log all trips made by more sustainable means (including public transport, walking and cycling), and thereby gain points which can be swapped for rewards provided by a variety of sponsors.

Ali Clabburn, founder of *lift*share, reports that overseas schemes often put

more emphasis on occasional long-distance journeys (e.g. to events) and less on commuting trips, as compared to schemes in the UK.

In the UK context, assistance from local authorities (or other clients) with marketing schemes is often seen as a key form of support that can be provided (and which determines eventual take-up of schemes). We were not able to find any international literature on this topic.

4.2.3 HOV lanes

HOV lanes have been a particular feature of American transport policy, though they have also been implemented elsewhere – including, for example, in New Zealand and Australia, where they are referred to as 'transit' lanes, or 'T2' and 'T3' lanes, depending on the number of ride sharers required. There is also a considerable literature on HOV lanes, dating back over a period of forty years. Notable overview studies from the USA include Turnbull (2005), Turnbull et al. (2006) and the US Department of Transportation (2011). According to these reports, there are at least 2,000 miles of HOV lanes in North America, spread across 27 metropolitan areas, though concentrated in six main locations. (Bus lanes appear to be counted within the definition, and about half of the HOV miles are reported to be on US freeways.) In particular, major HOV systems operate in Houston and Dallas, Texas; Seattle, Washington; the Los Angeles and Orange County area, and the San Francisco Bay region, in California; the area comprising Newark, New Jersey, and New York City; and the region of Northern Virginia, Washington DC, and Maryland.

The topic has sparked considerable debate, and there are concerns about particular lanes that they may:

- increase road capacity;
- encourage longer-distance commuting;
- abstract from public transport;
- do not achieve intended positive effects; and
- are underused.

For example, Kwon and Varaiya (2008) report on experience in California. They estimated that the mean time saving on an average 10-mile stretch of HOV lane in California (compared to the neighbouring general purpose lane) was only 1.7 minutes, and that there was little evidence that they have increased the number of people being carried on particular routes (although they still conclude that HOV lanes can play a useful role, particularly where there are significant numbers of bus pools or van pools; where they are part of a two-lane HOV/HOT facility[3]; and as part of an HOV/HOT bypass when joining a particular section of route).

3 A high-occupancy toll lane, or 'HOT' lane, is an HOV lane also open to single-occupant vehicles who pay a toll

Meanwhile, positive effects claimed for HOV and HOT lanes include the following:

- they provide journey time and reliability benefits;
- they encourage a shift from people driving alone to sharing vehicles, including increasing public transport use; and
- via these means, they reduce congestion and pollution.

Turnbull et al. (2006) report that most assessments of facilities have concentrated on the facilities themselves, rather than the broader travel corridors, making comprehensive analysis of their impacts problematic. However, from an overview assessment of the literature, they report that various surveys suggest: documented morning peak travel time savings reported from using HOV lanes (compared with general purpose lanes) ranging from 1 minute to 37 minutes; that 25–50% of those using HOV facilities previously drove alone; and that vehicle occupancies increase by an average of 8–9% following implementation of an HOV lane, though with considerable variation around that range. For example, they report that a ten-year study on the I-5 North in Seattle recorded a 36% increase in vehicle occupancies over the period.

They also argue that HOV facilities are more likely to have positive outcomes in certain contexts: in areas with a population of over 1.5 million; where they serve an employment centre with more than 100,000 jobs; where 25 or more buses can use the facility in the peak hour; where there is congestion, and the HOV lane can offer journey time savings of approximately 1 minute per mile, or 7.5 minutes in total, over the general purpose lane; and where there are supporting policies or initiatives in place.

4.2.4 Slugging

Where HOV or HOT lanes exist, 'slugging' can emerge – the creation of unofficial, ad hoc car-pool networks, often with published routes, and pick-up/drop-off locations. This practice first emerged in the Washington DC area in the 1970s following the creation of HOV lanes, frustration over the failures of public transport systems, and high fuel prices. It is essentially a form of hitchhiking between strangers, bringing benefits to both parties, since both drivers and passengers are able to use the HOV lane for a quicker trip, passengers travel for free, and HOV drivers sometimes avoid paying tolls.

Relevant websites publicising slugging opportunities and practical information appear to be provided by individual enthusiasts (and can be of variable quality). In the morning, 'slugs' form queues at local businesses or facilities such as park-and-ride sites, bus stops and metro stations (so that public transport can often be used if slugging opportunities do not arise). Drivers (or 'body snatchers') pull up to the queue for the route which they will follow, and either display a sign or call out the designated drop-off point to which they are willing to drive, and how many passengers they can take. Enough riders fill the car, and the driver departs. In the evening, the routes reverse.

The practice is longest established in the Washington DC area, and also occurs on particular routes around San Francisco, Houston and Pittsburgh. Chan and Shaheen (2011) summarise reported levels of usage as 900 daily participants in Houston (as of 2007); 6,459 daily participants in Washington DC (2006); and 8,000–10,000 daily participants in the San Francisco Bay area (1998).

Burris and Winn (2006) comment that a common feature of the Washington DC, San Francisco and Houston schemes is that the HOV lanes require three or more occupants, in contrast to most other US HOV lanes, which are for two or more occupants. There are two recent studies of relevance on slugging, which come to broadly similar conclusions about the types of people who slug, and the nature of the practice.

First, Burris and Winn (2006) describe a quantitative survey conducted at three park-and-ride sites in Houston, with 208 responses from those involved in morning peak slugging (which they term 'casual carpooling'). Of these, 93% had been involved in casual car pooling for more than a month, and 76% were slugging three or more times a week. However, only 7% were usually travelling with the same people. Of those travelling three or more times a week, the main purpose was commuting (96%), and there was an over-representation (by comparison with the population as a whole) of those aged 25–34 (who represented 28% of the subsample).

Second, Mote and Whitestone (2011) describe slugging in Washington DC, reporting on 26 separate slugging routes, extending out as far as 50 miles, and with one study suggesting that 11% of peak hour commuters using HOV

lanes around Washington DC are actually slugging. There is a book on slugging (outlining slugging etiquette), and a related website. Mote and Whitestone's work involved in-depth interviews with 12 participants. One of their key findings is that slugging is typically a much more anonymous activity than conventional car pooling, and that it works particularly well in that area because of the concentration of government employees. Specifically, when asked to describe others involved in slugging, respondents referred to people 'like us' which was expanded to mean 'Department of Defense personnel and civilians and federal government workers'. Mote and Whitestone argue that this sense of shared identity helps to overcome some of the usual concerns about safety and security. Interestingly, they argue that slugging is also supported by a set of norms which minimise the 'privacy invasion' of car sharing. For example, passengers are advised not to talk; not to ask to change the radio station, heating or air conditioning; not to make extended mobile phone calls; and not to read the newspaper. Meanwhile, informal information exchange between passengers at waiting points helps to spread information about dirty cars, bad drivers and the like. Mote and Whitestone report that many passengers and drivers see each other on a regular basis, but that travel combinations are usually variable, and those involved remain 'familiar strangers'. However, they note that this tendency reduces where distances involved are longer, such that slugging arrangements may evolve into car-pooling arrangements amongst particular groups. Finally, they note that despite the anonymity of arrangements, there is some sense of shared community and responsibility – for example, several respondents referred to a 'pity lane' where some drivers offer lifts outside HOV operational hours for those who have been working late.

4.2.5 Van pooling

Two notable reviews of van pooling include a review of US experience by Evans and Pratt (2005), and an assessment of the suitability of van pooling in the UK context by Enoch (2003).

Evans and Pratt state that van pools generally consist of 5 to 15 people, including a volunteer driver-member, who elect to commute together in a van. The majority are focused on home-to-work trips, and each commuter essentially rents a seat on the vehicle for a fixed period of time (whilst the driver usually travels free). They define three types of schemes – those run by employers, those run by third-party organisations, and those where the driver owns the vehicle. In the USA, van pooling doubled between 1974 and 1980, reaching in the order of 15,000 van pools in total. By 2005, they estimate that there were in the order of 10,000 in operation, accounting for 0.3% of all journeys to work – rising to 2% in the Puget Sound (Greater Seattle) area due to positive regulation. They also report that the 1990s was a period of transition from primarily employer-organised van pools to a situation where about half of all van pools were run by third-party operators.

The largest third-party private operator in the USA is VPSI. This service was launched in the mid 1970s, and, according to its current website, reports that it has over 5,000 vans and more than 25 million passenger trips annually. Other notable private companies include Enterprise Rideshare and 'easy street'. Meanwhile, King County Metro's Commuter Van Program is reported to be the largest public van-pool programme in the USA.

In terms of impacts, Evans and Pratt report that the evidence shows that van pooling works best where one-way trip lengths exceed 20 miles; where work schedules are fixed and regular; where employer size is sufficient to generate 5–12 people commuting from the same area; where public transport is inadequate; or where some congestion or parking problems exist. The typical van pooler's journey is, on average, 10–12 minutes longer than if they drove themselves, but they usually experience reduced costs and less driving stress. Individual employer schemes in 20 case studies examined in the late 1980s were successful at attracting a median average of 8% of employees. Van-pool passengers are reported to have socio-economic profiles which are more like those of car drivers rather than public transport users, and, on average (excepting the evidence from some van-pool programmes serving central city areas), slightly over half of new van poolers were reporting that they were previously driving to work.

In our correspondence with Avego, they highlighted the availability of federal grant money for van pooling, reporting that in some states this funding is sufficient to make such services revenue-neutral to those taking part, and emphasising that this constitutes a positive form of promotion.

Meanwhile, in terms of European experience, Enoch reports on van pooling in the Netherlands. He notes that the practice took off there, following VPSI's acquisition of Vipre, which now acts as its Dutch subsidiary and offers 'drive-sharing' solutions. Enoch notes that this is essentially van pooling, but often using vehicles which are smaller than those typically used in the USA, both because of the need to have a special driving licence to carry more than eight passengers, (the limit being 14 in the USA), and because clusters of those wishing to travel together may be smaller due to the geography of the country. Vipre's current website reports that it supports more than 2,000 commuters daily.

Enoch also considers the suitability of van pooling in the UK (as reported in the previous report). In particular, he notes that:

- a special licence is required to drive a van carrying more than 8 passengers (compared with 14 in the USA);
- employer-supported van pools in vehicles with fewer than nine seats would be taxed as a benefit-in-kind, and the main driver would be considered, for tax purposes, to be allocated a company car (and would therefore have to pay tax accordingly);
- insurance companies seem reluctant to back schemes (although their accident record is generally good);
- both the public and policymakers are relatively uninformed about the concept; and
- van pools in the USA appear to work best where employees for the same company live relatively close to each other but over 25 km from their workplace, and it is unclear how often this situation would apply in the UK.

He concludes that van pooling in smaller vehicles could have potential in some locations in the UK, but would need greater institutional support than is currently present.

4.2.6 Sharer parking / park-and-pool

Offering parking privileges at destinations to those who share cars is a common technique used to encourage higher vehicle occupancies. In the UK it is a relatively common feature of workplace car-sharing schemes, and, as mentioned, we were able to find one example of a citywide scheme in Milton Keynes.

The international literature also indicates that parking privileges at workplaces (or other sites) are often introduced to encourage sharing. For example, Rose (2002) relates that the introduction of a car-pool car park at Monash University in Melbourne, Australia, was proving popular, following changes to its location and access technology. (In general, self-enforcing access techniques to encourage sharing – such as requiring the simultaneous use of two separate parking permits – are becoming increasingly common.)

Meanwhile, Turnbull et al. (2004) provide some information on park-and-pool facilities in the USA, which they define as being 'established to provide locations for the formations of carpools and vanpools and parking for non-pool vehicles used for access'. These offer a different kind of parking facility, since they are aimed at enabling people to form car pools, rather than offering improved parking conditions for those who have already done so. (As previously mentioned, the only similar scheme that we have identified in the UK is an unsuccessful 'park-and-share' facility in South Gloucestershire.)

The report indicates that park-and-pool facilities are not an uncommon feature of US state policy, and Turnbull et al. refer to evidence relating to six specific systems:

- reports from 1978 and 1979 about park-and-pool facilities in Dallas and Miami;
- evidence from 1996 about 237 parking facilities in Connecticut, of which 115 were being used exclusively for car- or van-pooling;
- evidence from 1986 and 1998 about three park-and-pool lots located near a freeway in Houston;
- a report from 1991 on 35 park-and-pool lots in Sacramento;
- a report from 1999 about 30 park-and-pool lots in San Diego; and
- evidence from 1988/90 and 2003 of about 64 park-and-pool lots in Maryland (of which six also offered park-and-ride).

From reviewing the evidence relating to these systems, Turnbull et al. report that park-and-pool car parks tend to be in locations not served by fixed-route public transport, and often have less than 100 parking spaces. They are typically located in suburban and rural areas, free for users and usually have few facilities. Some sites offer a combination of park-and-pool and park-and-ride opportunities, especially those located near an HOV lane. Utilisation typically varies between 15% and 66% (median 40–50%); and car-pooling activity typically entails an average of 2.5 vehicles entering the car park for every vehicle that exits (though with higher levels of average sharing reported in a number of cases). Moreover, it is reported that the destinations for car poolers tend to be relatively dispersed, and are usually work related. The report on park-and-pool in Connecticut included a comparison of 1980 and 1990 census data and concluded that the park-and-pool facilities were leading to an overall increase in car occupancy. In a 1988 survey of park-and-pool users in Maryland, 46% reported that they had not participated in ride sharing before starting to use the facility.

4.3 Significant trends and developments

4.3.1 Dynamic lift sharing

With lift-sharing schemes, there is a growing interest in being able to provide dynamic matching services, where people offering/wanting lifts can match up in real time – for example, by using a mobile phone app. In the UK, *lift*share is exploring these options. The US organisation Carticipate has developed a specific iPhone app. In France, there is a scheme being trialled by the General Council of Isère, in Grenoble and in Vercors, as reported on 1 December 2010. In this scheme, drivers specify whether they are able to take a passenger, and then receive a text message if a passenger requests a relevant destination. Matching (or not) is reported to be achieved within two minutes. Drivers are reimbursed by the council, whilst passengers receive a free ride.

Meanwhile, the company Avego currently offers a dynamic ride-sharing service which they report is used by 'thousands of commuters in 65 countries'. They have begun various formal pilots – notably in Seattle, USA (launched in January 2011) and Bergen, Norway (launched in April 2011). Both pilots are targeted at commuters on key corridors and both have received substantial public funding. There are plans for further trials in the Netherlands and the USA. More details are given in section 4.4.

4.3.2 Use of social networking sites

Another evolving feature of lift-sharing solutions is increasing linkage to social networking sites. Given that lift sharing relies on direct personal contact, and cooperative arrangements between people who may not know each other, it is obvious why social networking links may be proving particularly important for lift-sharing solutions. In the UK, *lift*share has a standard Facebook group page, linked to its main site. *lift*share place announcements on the Facebook wall linked to articles on the main website. Users also post details of their lift-sharing offers or requests. The administrators sometimes direct people to the main website. As of 10 June 2011, there were 601 'likes' of the page, up from 592 on 18 May 2011 (Hutchins & Binsted, 2012).

During the course of the research, links between lift-share providers and social network sites were mentioned as follows:

- PickupPal reports that it integrates with various social networking tools, making it easier for people to share rides with others who have similar interests or with whom they are already connected via colleagues or friends.
- Zimride, as mentioned, is linked with the car club Zipcar, and reports that it has a system allowing individuals to drive a Zipcar or their personal vehicle, and share the car ride among a personalised network of friends. Specifically, Zimride is making use of Facebook, allowing its users to view profiles for common networks, interests and friends before deciding to share a ride. The Zimride community has benefited from a recent Facebook (fbFund) grant, given in recognition of Zimride's useful and innovative integration with their platform.

Chan and Shaheen (2010) also identify the matching sites 'GoLoco' and 'gtrot' as being particularly focused on using social networking to encourage ride sharing (see the section 'Matching schemes' in the references for the website URLs of GoLoco and gtrot).

4.4 Avego case study

This case study is based upon the sources listed in the references, and information supplied by Jonathan Guard and Taras Kennedy of Avego, July 2011.

4.4.1 Overview

Founded in 2007, Avego is a global provider of software, hardware and professional services for improving the efficiency of passenger transportation. Avego has developed a ride-sharing system that matches drivers and riders in real time as they travel, via a free application that runs on the iPhone or Windows Phone 7. The system works by allowing drivers running the application to be matched in real time with anyone searching for a ride along the same route. The system combines this GPS-enabled real-time ride matching with fully automated payment transaction management, real-time passenger information, safety features, and commute reporting. Participants need to provide some background information when registering to use the service. Avego sets fixed rates which are automatically debited from passengers when they travel, and credited to the driver. (Avego takes a small percentage of the rider fee as it is passed into the driver's account.) Passengers and drivers are given a unique code enabling them to match up when they meet.

In terms of behavioural monitoring, levels of usage are recorded. In addition, the routes of those using the system are collated and mapped through central systems.

Avego report that their system is used by thousands of commuters in over 65 countries around the world. They are also involved in several specific pilots.

4.4.2 Seattle pilot

Since January 2011, a large-scale pilot of Avego's scheme has been taking place in Seattle, focusing on commuters on the State Route 520 corridor. Avego has aimed to get 1,000 commuters signed up to the pilot, offering both drivers and passengers financial rewards to encourage regular participation. This pilot programme is funded by the state and is to complement state and local efforts to help manage congestion and reduce emissions along the SR 520. The pilot has received a grant of $400,000. In the pilot, drivers earn $1 for the first mile, and 20 cents per subsequent mile per passenger (capped at a limit of an average 50 cents per mile by tax regulations).

4.4.3 Bergen pilot

Photo courtesy of Avego

In April 2011, another Avego real-time ride-sharing pilot started in Bergen, Norway. The pilot is focused on a key corridor between a busy business park near Bergen airport and Bergen city centre. Nine local employers, with over 7,000 staff, have agreed to take part in the pilot. The programme is being funded initially by a 1 million krone grant from the Norwegian Transport Authority, with an additional 1.5 million krone also being available with the expansion of the programme beyond the first phase.

4.4.4 Future experiments

Avego are hoping to undertake a major pilot of the scheme in the Netherlands and some other major pilots in the USA, each with hundreds of drivers. They are also seeing some 'pilots' spontaneously emerge, for example in St. Louis, Minneapolis, and the San Francisco Bay area. Guard reports that they have had some interest from local authorities in the UK, but that these have not yet become specific plans.

4.4.5 Key success factors

Guard argues that real-time ride sharing requires a critical mass of drivers and riders to be successful, with enough drivers available to provide a ride every three to four minutes. Avego are focusing their experiments on commuter corridors where commuters are travelling typically more than 10 km to their place of work.

Avego report that they do not necessarily need substantial public investment in their system, but they do require a positive attitude 'to extend the public transport network to include the car', promotion of their scheme and potential

incentives (as given in the next paragraph). In addition, signage to signify appropriate pick-up points can be useful.

In the USA, Avego is lobbying for its scheme to be eligible for the kind of federal grants that are currently available for van pooling. It also feels that government can promote ride sharing through the provision of HOV lanes, preferential parking arrangements for sharers, and tax reductions. Avego feels that government requirements for expensive background checks on participants would be detrimental, and, moreover, that it is important that UK insurers do not differentiate their insurance premiums on the basis that the driver is a member of a car pool or a ride-sharing scheme.

Guard notes that ride-sharing solutions are likely to become increasingly popular given petrol prices rises, traffic congestion, parking issues and climate change concerns. He also argues that the scheme helps to maximise the use of vehicles and infrastructure; and that passengers are paying drivers from their community, which, in turn, may help to ensure that such vehicles are retained as a potential community asset, which, he argues, may be particularly important in rural communities in the future.

5. Taxis / Expert Driver Solutions

5.1 Summary of UK experience

Defining the scope of 'expert driver' solutions is problematic, as the topic area shades into the more general areas of demand-responsive transport, including voluntary car schemes and/or more flexible bus services, and indeed van pooling (discussed in an earlier section).

Demand-responsive transport has its own wide literature, including, for example, Nutley (2000), Enoch et al. (2004), and Mulley and Nelson (2009). Whilst these options were previously limited to particular classes of user (such as the elderly and those with mobility difficulties), such 'flexible transport services' are becoming increasingly 'open access' and integrated with the mainstream transport mix (Mulley & Nelson, 2009). In order to keep the scope of this review manageable, we have concentrated primarily on taxis, and shared-taxi solutions, which are clearly available to everyone, although it is also obvious that the boundaries are somewhat blurred, not least because a number of shared-taxi schemes use larger-than-average vehicles.

Cooper, Mundy and Nelson (2011) report that some form of taxi service has operated in the UK since the 17th century. Currently, as outlined in Cairns (2011a), approximately 10% of people use conventional taxis or minicabs at least once a week, whilst a further 18% use them at least once a month, meaning that they constitute a non-trivial part of mainstream transport options.

However, UK experience of *shared*-taxi schemes is far more limited, with a number of failures. (For example, Enoch et al. (2004) report on unsuccessful schemes in Blackpool, Swindon and Ipswich, and at Marylebone and Kings Cross stations in London.) In 2008, the issue was explored by the Commission for Integrated Transport (CfIT, 2008), who identified a number of successful examples. These were primarily schemes which aimed to address social exclusion issues for particular groups, notably the elderly or those living in remote areas, with high levels of use typically reported by elderly women for shopping and personal business. Wiltshire's Connect2 scheme was notable, given its scale (25,000 passengers per year), and its integration of taxi provision with other forms of public transport. Other examples included Devon Fare Car (operating in 11 communities in Devon, with 17,000 trips per year), Rural Wheels in Cumbria (with approximately 5,000 trips per year), North Sunderland Taxis (operating in a sparsely populated part of the Scottish Highlands, with 1,800 passenger trips per year) and Billilinks in West Sussex (operating on two routes around Billingshurst, with 350 trips per year).

The UK shared-taxi schemes were notable for some of the social benefits reported. For example, in 2005, in a survey of users of Devon Fare Car, 18 people reported that they would give up a job if the service were stopped, and 26 reported that they would not be able to go out on a regular basis. However, in general, impact data were remarkably limited. This was particularly true for conventional taxi operations, although some analysis suggested that occupancy levels would be a key issue in determining their relative environmental credentials, which indicates that shared-taxi schemes could be particularly beneficial.

5.2 Scale of international experience

The 2008 CfIT report also looked at five examples of shared-taxi schemes abroad. Relevant websites have been used to update the information on these, and we have also come across some relevant information relating to various other schemes. In some locations, such as Washington, informal taxi sharing is also reported, where taxi drivers choose to pick up more than one passenger. The main schemes that we have looked at are shown in Table 5.1. Seven of the schemes investigated focus on serving other modes of transport (as discussed further below), and five are focused on rural locations, or locations with a dearth of public transport options. Two are city-based schemes aimed at providing night-time services. The schemes are generally run by a variety of different organisations.

Available information about schemes was, again, remarkably limited. In terms of users, there was some information from SuperShuttle (as reported in the case study at the end), and some from Taxibus (Dufour, 2004). Of the 10,200 Taxibus users registered between 1993 and 2000; 68% were female; 57% had a driving licence, though only 22% had a car; 47% were students / 30% employed / 9% retired; and 5% were under 18 years of age / 29% 18–24 years old / 46% 25–50 years old / 20% aged 50 or over. The SuperShuttle data also suggest a higher proportion of female users, and a significant number of student users. Mott MacDonald (2008) reported that the proportion of elderly users in some of the CfIT case studies was 12% for TAXiTUB, under 30% for Regiotaxi, and 60% for PubliCar, indicating that age profiles vary significantly, depending on the type of shared-taxi scheme.

Table 5.1: Examples of shared-taxi schemes

Scheme	Details
SuperShuttle	Operates in the USA, Paris and Stockholm, primarily focused on travel to airports, with more than 8 million passenger trips pear year.
Hitchsters	Operates in New York and San Francisco, connecting travellers to local airports, with plans for launches in three other areas (Boston, Chicago and Washington DC).
Prime Time Shuttle	Operates in southern California, connecting passengers with six airports and three harbours.
Taxibus	Operates in the Canadian city of Rimourski, providing shared-taxi trips between 300 designated stops, with an extended service into the wider hinterland and links with the bus services. Reported to have 77,000 trips annually by 2002, with an average occupancy of 2.8 passengers per trip, and to have led to similar schemes in other Canadian towns.
Connexxion	Operates across the Netherlands.
TreinTaxi	Provides travel to and from 38 stations, in 59 cities across the Netherlands, serving an area of approximately 8 km around each station. Reported to have 2.2 million passenger trips pear year in 2008.
PubliCar	Operates in low-density rural areas and small towns across Switzerland, in many cases providing connections to the main public transport network. PubliCar in Vaud reported that it had 112,500 passenger trips pear year in 2008.
Regiotaxi	Operates in four regions of the Netherlands, focused on rural areas. Regiotaxi KAN in the Arnhem-Nijmegen region reported to have 1.4 million passenger trips pear year in 2009.
TAXiTUB	Operates along defined corridors in the north-east of France, whose main purpose is to feed into the mainstream bus service stops. Reported to have 34,000 passenger trips per year in 2010.
Anruf-Sammel-Taxis (AST)	Operates in urban fringe and rural communities in Germany to supplement public transport. AST in Miesbach reported to have 17,000 passenger trips pear year in 2008.
Collecto	Operates at night in Brussels.
AST	Operates at night in Linz.

Source: Authors' own

5.3 Significant trends and developments

5.3.1 Integration with other modes

Unlike the situation in the UK, there are a number of successful international shared-taxi schemes where the main aim is to provide access to another mode of transport – specifically buses, and modes operating from ports, train stations and airports. In the UK, experience of such schemes is limited – there is a new scheme starting in Milton Keynes which will link with the train station (whilst, as previously noted, Enoch et al. (2004) report on failed schemes to service stations at Ipswich, Kings Cross and Marylebone). Successful experience abroad includes:

- SuperShuttle, Prime Time Shuttle and Hitchsters, which are all services specifically aimed at enabling travellers to share taxis to and from local airports (and, in some cases, ports or train stations). SuperShuttle has recently expanded into Europe – more details are given in the case study in section 5.4;
- TreinTaxi, run by Dutch State railways, exists to provide links to 38 stations;
- PubliCar, in Switzerland, is focused, in part, on providing connections to the main public transport network; and
- TAXiTUB, in the north-east of France, is intended mainly to feed into the mainstream bus service stops.

5.3.2 Night-time taxi services

We are aware of two shared-taxi schemes which appear to have been set up primarily to cover a deficit in night-time transport. Enoch et al. (2004) report on a service introduced in Linz in 1987, whereby passengers could book a ride up to 30 minutes before departure, between 10 p.m. and 3.30 a.m., from 180 stops around the city, and be dropped to their door. This service appears to be still in operation (and the website implies that it may also have extended to offer shared services during the day). Meanwhile, Dufour (2008) reports on the development and adoption of a similar (albeit considerably larger) scheme in Brussels, designed around the Linz model. This is called Collecto, and was launched in September 2008.

Specifically, Dufour reports that the service evolved as a result of two factors. First, higher political priority was given to taxis, with the Brussels Minister for Transport (Pascal Smet) setting out a Taxi Policy Plan in 2005, which addressed issues such as cab and cab rank design, pricing, taxi vouchers, use of dedicated bus lanes, social legislation and driver training. Second, the public transport operator STIB/MIVB set out to create a night transport offer of 20 bus routes, which was always seen as requiring complementary taxi provision.

The Collecto service was designed to provide a cross between the flexibility of taxis and the efficiencies of public transport by offering a stop-to-door service between 11 p.m. and 6.00 a.m. Passengers book rides up to 30 minutes before departure, on the half hour, and wait at one of 200 pick-up points, marked by a specific sign. There is a flat fare system, with a reduced rate for STIB or MOBIB card holders. Services are provided by conventional taxis that group up to four passengers travelling in the same direction, and passengers are dropped at their door. The service is subsidised by the regional authorities, and STIB/MIVB were involved in the design and set-up of the service.

5.3.3 Key factors determining success

The literature provides some information on factors which are likely to be key to the success of shared-taxi schemes.

5.3.3.1 Critical mass and operational scale

It seems clear that critical mass is one necessary condition for the success of services, meaning that they are often concentrated along key corridors or serving key destinations. As highlighted in the SuperShuttle case study below, the scale of movement needed may be very substantial. SuperShuttle experience also indicates that relevant journeys may need to be relatively long in order for shared arrangements to make sense.

During the previous study, it was reported that, in the Netherlands, moving to a national system of taxi licensing made it possible for shared-taxi services to be provided to a number of provinces and cities by an operator with a national reach, 'Connexxion'. Connexxion (which also operates bus, train, tram and ferry routes) has been able to achieve significant economies of scale compared to shared-taxi services in the UK – for example, by running a small number of call centres (rather than a separate call centre for each town or province). Operations such as that provided by Connexxion would be impossible in England, where any taxi operator wishing to provide a similar shared-taxi service would have to secure a separate taxi licence in every district or unitary authority in which they wished to operate, often with different rules and restrictions. Research by CfIT (2008) concluded that removal of the unnecessarily restrictive requirement for taxi operators to be licensed at district level (and their replacement by a simpler national or regional licensing system) was needed in order to open up the UK market for large-scale shared-taxi services.

During the recent inquiry into legislation for taxis and private hire vehicles by the House of Commons Transport Committee (2011), moving to a national licensing system was rejected, 'not least because of the likely cost and complexity', though a thorough overhaul of the legislation was recommended, one recommendation being that new legislation 'should permit existing licensing districts to be combined where the local authorities decide it is best to do so'. The Committee also argued that there is a case for national standards in relation to issues such as the level of criminal record checks that drivers require; the roadworthiness of vehicles; and ensuring that drivers whose licence has been revoked in one district are not licensed shortly afterwards in a different district.

5.3.3.2 Funding issues

CfIT also reported that funding issues were potentially a barrier to the set-up of shared-taxi schemes in the UK, noting that taxi operators were not able to access conventional public transport funding schemes such as concessionary fares or the Bus Service Operators Grant, and were not able to claim exemption from VAT, owing to the small size of their vehicles. In contrast, for example, Taxibus in Rimourski is recognised as being public transport by the Quebec government, and is therefore eligible for provincial aid in proportion to revenues received (Dufour, 2004).

Mulley and Nelson (2009) also argue that, in the UK, short-term subsidies to start up schemes have often not provided sufficient time to build up the patronage needed to provide a sustainable funding model. They also comment that funding in continental Europe for flexible transport services is often provided from a single transport budget, whereas, in the UK, responsibilities and budgets for the mobility needs of different groups (such as school children, the mobility-impaired, social service passengers, and those travelling for a health appointment) are often fragmented, meaning that considerable partnership work is required to provide funding for generic services.

5.3.3.3 Regulatory issues and institutional support

The SuperShuttle case study indicates the significance of the regulatory arrangements put in place in terms of where and how they can operate, what charges they can levy, and the nature of support provided at key destinations. This echoes findings by both Enoch et al. (2004) and CfIT, namely that a local authority's approach to the issues can be key, and affect the overall success of the scheme. For example, Enoch et al. report that one factor in the failure of the Swindon scheme was that drivers were advised that they would have to invest in roof signs that were, in practice, unnecessary. It is interesting that a number of the shared-taxi schemes described above effectively have either fixed departure or fixed arrival points (being either door-to-stop or stop-to-door), which are often demarcated with appropriate signing (provided by, for example, a local authority or airport operator). Supportive policy documentation may

also be important. Cooper, Mundy and Nelson (2010) report that taxis have often been neglected in transport policy, and the recent House of Commons Transport Committee review specifically recommends that the government should provide clearer guidance to local authorities on how taxis and private hire vehicles should be included in local transport plans.

5.3.4 Variety of operational models

The shared-taxi schemes described above have been set up by different organisations, and have different operational characteristics. Specifically:

- Hitchsters is a private company which does not provide the taxis itself, but supplies them via a partner organisation.
- SuperShuttle, Connexxion and PubliCar are all run by public transport companies.
- TreinTaxi is provided by the Dutch State Railways.
- Contracts for the provision of Regiotaxi are let by the provincial government to commercial operators.
- Collecto is subsidised by the regional authorities.
- Taxibus was set up as a partnership between 'Compagnie de taxis 800 inc.', a cooperative of the local taxi drivers (42 drivers, as of 2000) and Taxibus Corporation, a non-profit-making organisation established by the City of Rimourski.

5.4 SuperShuttle case study

This case study is based on website information, and discussion with Christiane Just, Director of International Business Development, SuperShuttle Inc., July 2011.

5.4.1 Overview

SuperShuttle is a wholly owned subsidiary of the company Veolia Transportation, and began operations in the USA in 1983. Within the USA, it offers a shared-ride door-to-door airport shuttle service. Currently, SuperShuttle provides service to and from 33 airports and over 50 cities in the USA. It has approximately 1,200 distinctive blue-and-yellow vans on the road, and caters for more than 8 million air passengers per year. In some cases (such as Miami), it also offers shared rides to ports. Journeys can be booked online or by phone, up to four hours before pick-up time. Passengers can book either a shared ride or an exclusive trip. There are discounts available for regular corporate clients, and many links with the hospitality industry. Advanced, centralised and fully integrated booking and dispatch systems are reported to be part of its success.

Following successful operations in the USA, in 2009 SuperShuttle expanded into Europe, and now also provides services in France (to and between the

three Paris airports and seven Paris train stations) and Sweden (to Stockholm airport, for shared rides only). SuperShuttle is considering potential future operations in various locations across Europe (including the UK).

In general, in terms of price, SuperShuttle aims to position itself between a taxi and a bus. Customers enjoy a cheaper ride than would be the case if they took a taxi alone, and they retain the comfort of a door-to-door ride, although forfeiting some time (given the need for several stops). (In some cities, Veolia also operates taxi and limousine services, alongside the SuperShuttle offering.)

5.4.2 Factors determining successful operation

Various issues are identified as being key to successful operation.

The first relates to the nature of the catchment. SuperShuttle usually works with airports with at least 4 million passenger movements, so as to have sufficient critical mass for the service to be successful. It also tends to work best where the airport (or other end location) is located some distance from its associated city, such that journeys are long enough to justify arrangements, and where there is a relative absence of public transport options. The service tends to rely on pick-ups from hotels, corporate clients and individual residences, and a balance of different users is needed, given varying seasonalities of demand.

Photo courtesy of Supershuttle

Second, the regulatory arrangements in the surrounding catchment are relevant. For example, these might affect the number of local authorities that SuperShuttle would need to interact with; the area in which it can operate; the routes it is allowed to run on (if regulated similarly to bus services); and/or the pricing structure it can use. SuperShuttle typically works with a postcode-based fares scheme, and needs to be able to charge the individuals using the service separately. Fares for residential clients usually involve a fixed price for the first user and a considerably lower price for the second and third users, or a fixed price for full use of a vehicle (with up to eight seats). However, the nature of the service offered varies with location. For example, in Stockholm, SuperShuttle is limited to operating to and from the airport only, and is not licensed to sell 'exclusive rides' (i.e. to sell the whole van and not just a seat in a shared-ride arrangement).

Third, a positive arrangement with the airport operator and appropriate facilities are key. These are likely to include appropriate signage, a holding area (for waiting vehicles), airport operator involvement in service launch and marketing, and a well-signed pick-up location close to the passenger arrival area. Some airports provide a counter selling SuperShuttle tickets. With smaller airports, SuperShuttle feels that it is important to have a period during which they are the only shared-taxi operator allowed to operate from an airport, in order to establish the business.

5.4.3 Nature of customers

SuperShuttle conducts an annual online customer satisfaction survey. In 2010, approximately 9,000 responses were received from their US survey work. These indicated that:

- 60% of users were female;
- 76% were travelling alone (17% as couples, 7% in groups);
- there was a relatively even distribution of ages (12% aged 18–24; 26% aged 25–34; 26% aged 35–49; 29% aged 50–64; 7% aged 65 or over);
- most users were flying more than once a year (with actual rates being 21% once a year; 48% 2–3 times a year; 24% 4–7 times a year; 4% 8–10 times a year; 3% more than 10 times a year);
- 68% users were in full-time employment and 13% were students;
- levels of satisfaction with the service were high (for example, 87% considered the service to be good value, and 93% considered it to be reliable); and
- a significant proportion of the business was attributable to indirect sales (for example, via online travel agencies such as Expedia).

6. Summary and Conclusions

6.1 Background

This report builds on a previous study (Cairns, 2011a) which examined a range of alternatives to the most common way of accessing cars – that of households owning the vehicles which they use. These included renting vehicles, getting a lift and taking a taxi. Some or all of these alternative options can potentially offer a number of benefits, for both individuals and society, by:

- moving people away from habitual car use, and increasing the incentive for people to consider cars as a form of transport to be used in conjunction with other modes;
- improving social inclusion by providing greater choice to those without access to a car;

- increasing choice and flexibility by providing people with occasional access to cars (or to second cars) on a cheaper basis than that of personal ownership, thus bringing particular benefits in areas which have few other options or suffer from parking scarcity;
- encouraging more efficient use of road space and/or parking land by reducing the space needed for cars, yielding benefits such as reduced congestion and improved streetscape in urban areas, and helping to improve quality of life;
- both directly and indirectly facilitating the take-up of electric vehicles and other lower emission vehicle technologies;
- enabling people to become non-car-owners or remain non-car-owners for longer, or to reduce the number of cars in their household;
- encouraging or enabling people to own or use smaller or cleaner cars where larger, less fuel-efficient ones are not needed;
- providing improved access to rail for longer journeys;
- reducing the resources consumed, or the emissions created, by transport; and
- offering relatively popular and cost-efficient alternatives to mainstream car use.

The previous study examined UK experience, focusing on whether such options were proving feasible and realistic, what impacts they were having, and what policy issues were reported to be affecting their take-up. It found that there were a number of different, dynamic developments in this area, with some schemes reporting rapid take-up. Evidence about impacts was patchy and mixed, but at least some of the benefits described above were being quoted in relation to some or all of the schemes. Moreover, those involved in schemes felt that there were a number of different ways in which the public sector could encourage their further development.

One theme to emerge was that pay-as-you-go car use was likely to result in more ‘rational’ car use than habituated, pay-up-front, private-ownership car

use, so that, if providing these options helps to reduce ownership levels or prolong non-car-ownership, the environmental impacts are likely to be positive.

6.2 This study

This study has aimed to build on the previous work, by examining international experience on the topic in continental Europe, North America and Australasia. It aimed to answer the same questions as were raised previously, namely:

- Where and for whom are alternative forms of car ownership and use proving feasible and popular?
- What are their impacts?
- What factors affect take-up and/or optimise their outcomes?

However, whilst the previous study was particularly focused on impact data, this study has focused more on the first and third questions – i.e. where are schemes proving workable, and what has made them successful?

It has been based primarily on a search of the literature and relevant websites, supplemented by obtaining more detailed information about three case study schemes – the city car-hire scheme car2go; the dynamic ride-sharing system offered by Avego; and the shared-taxi service run by SuperShuttle. The research took place in June and July 2011. In practice, the literature is extremely patchy, and, as in the UK, this is clearly a very dynamic field, where a great deal is happening, much of which is being led by private-sector organisations, and much of which is not well documented by academics, or in other written literature. The following section describes the main evidence relating to particular initiatives, and is followed by a discussion of the more general themes that emerge.

6.3 Nature of existing initiatives overseas

6.3.1 Overview

As in the previous review, this work is focused on the three topic areas of:

- **vehicle rental / drive-yourself solutions** – such as conventional vehicle rental; car clubs (where people rent vehicles parked in the neighbourhood); and other, more innovative forms of rental;
- **lift- or ride-sharing / drive-sharing solutions** – including informal car sharing, formal matching schemes, high-occupancy vehicle (HOV) lanes and shared-parking schemes; and
- **taxis / expert driver solutions** – specifically taxis, and shared-taxi schemes.

6.3.2 Vehicle rental

Just as in the UK, car rental is well established internationally, but there is remarkably little literature about it. Meanwhile, car clubs are becoming an increasingly global phenomenon, with positive impacts being reported that are similar to those reported for clubs in the UK. One estimate suggests that there are currently about 1.25 million members globally, of which about half are based in North America, and that numbers are growing rapidly (IMR, 2011). The largest car club in the world is Zipcar, and its UK operation accounts for a non-trivial proportion of its members. Meanwhile, there are two important developments – the growth of city car-hire schemes, which are similar to car clubs, but with important additional features, such as the possibility of one-way rentals; and the growth of peer-to-peer rental schemes (where people can rent cars from neighbours). City car-hire schemes appear to be developing fast, following the success of car2go (a Daimler venture). Peer-to-peer rental schemes are currently relatively embryonic, but are also growing fast. It is notable that, aside from peer-to-peer rental, the other schemes all appear to be early adopters of lower carbon vehicles, with rental companies, car clubs and city car-hire schemes all leading in the take-up of electric vehicles. It is also notable that car access technologies are a major feature of many schemes – for example, a number of the peer-to-peer rental companies include options for adapting the cars of the drivers who join in order to facilitate access.

6.3.3 Lift- or ride-sharing schemes

Many formal matching services exist in other countries, including notable schemes in the USA, Spain, France and Germany. The French scheme – Covoiturage – is intriguing, since statistics on its website imply that it may currently be the largest scheme in the world, though we were unable to obtain further information about it through the literature. Meanwhile, there is considerable experience, particularly in the USA, with other initiatives that facilitate ride sharing. These include: HOV lanes; the informal accompanied

development of 'slugging' (where drivers and passengers team up to mutually benefit from use of the HOV lanes); van pooling (where people car-share in larger groups of 5 to 15 people); and park-and-pool facilities (where parking is provided to enable people to make a ride-sharing arrangement). It is notable that most of these initiatives tend to facilitate ride sharing for commuters with relatively long journeys. A relatively new form of ride-sharing initiative is dynamic ride sharing – where mobile phone technology now enables drivers and passengers to be matched up in real time, and for automated payment transactions to take place (so that those picking up passengers can receive a guaranteed payment when they do so).

A relatively under-discussed but crucial issue for ride sharing relates to the safety implications of sharing with strangers. It is notable that ride-sharing sites may become increasingly linked to social networking sites, given that they provide the ability to screen potential lifts. Meanwhile, several commentators argue that demands for extensive background checks on participants by public authorities could be detrimental to schemes. Instead, successful schemes seem to rely on participants feeling that the people they are sharing with are in some way identifiable or registered. For example, the slugging research suggests that people feel that they are sharing with people 'like us', whilst Avego does require people to register (and performs some background checks). The success of schemes for commuting, events and at universities is perhaps because, in all these cases, participants are potentially identifiable – via their employer, university or the event organiser.

6.3.4 Taxis

As with conventional vehicle rental, taxis are clearly an established part of the global transport mix, but there is remarkably little literature about the scale or impacts of their operations. Meanwhile, we were able to identify a number of shared-taxi schemes. For the most part, these seem to exist for one of three reasons: to fill a gap in public transport provision, particularly in rural areas; to serve other forms of transport (in particular to link with airports, ports, train stations, and bus services); or to provide a safe and convenient form of night transport. Notably, in the UK, the only successful schemes of which we are aware are ones that fulfil the first of these three purposes. Meanwhile, schemes abroad are clearly well established. SuperShuttle – our case study in this area – caters for over 8 million passengers a year (mostly travelling to airports in the USA), whilst TreinTaxi provides a shared-taxi service to 38 stations in the Netherlands. More information on the experience of the Brussels night-time Collecto shared-taxi scheme could be of value.

6.4 Key success factors

This section examines the factors that those involved in schemes consider to be important to their success.

6.4.1 Critical mass

It is clear that almost all of the schemes described above rely on having a critical mass of users in order for them to be viable, although the nature of the users is not the same. In general, it seems that:

Vehicle rental solutions seem to appeal to a higher proportion of men than women. In formal schemes, vehicles need to be used throughout the day to be viable, and, as such, are not usually focused on commuting flows (though corporate use is clearly a substantial part of the conventional rental market). Areas of high population density with parking scarcity, and, conversely, relatively remote areas with few public transport options, may both provide a natural environment for particular types of scheme. University campuses are particularly popular locations for car clubs in the USA, and, given the potential importance of travel habit formation in youth, it is notable that some of the new forms of rental (such as car2go and DriveNow) may not restrict use by younger drivers.

Ride-sharing schemes seem to have been particularly successful for commuting trips, particularly for people making relatively long journeys from areas not well served by public transport, and where movements are concentrated along particular corridors. Major events and university campuses seem to provide the other two main foci for such schemes.

Shared-taxi schemes seem to appeal to a higher proportion of women than men. They often seem to rely on a high concentration of people wanting to access a particular destination (e.g. an airport or a more mainstream bus route) or to leave a particular location (e.g. a city centre at night-time). They also rely on having a diverse mixture of users in order to achieve sufficient levels of demand throughout their operating hours.

6.4.2 Public sector attitude and policy

It was notable that all of our interviewees talked about the attitude of those they were working with as being a key factor in establishing initiatives.

There was considerable concern that those working on encouraging sustainable transport assume that anything car-related is bad, whereas those promoting the types of schemes reported here aim to position their offering as an important part of the transport mix. For example, car2go argued that their scheme represents a shift from ‘many private cars to fewer public cars’; Avego see their scheme as ‘extending the public transport network to include the car’; and SuperShuttle argued that they offer a compromise between public transport and a conventional taxi.

Conversely, one consultee highlighted that the opposite attitude can also be problematic – namely, where decision-makers are concerned about being seen as ‘anti-car’, it can be difficult to argue the case for prioritising certain types

of car use, or measures such as HOV lanes. For example, in removing the M4 bus lane, Phillip Hammond (UK Secretary of State for Transport at the time) said: 'I believe excluding road users in this way is unfair and damaging to the economy' (DfT, 2010 – see the section 'High-occupancy vehicle lanes' in the references).

Other problems reported in the literature are: a lack of discussion of the options considered here in public policy documentation; ignorance about services; and a lack of clarity about impacts (partly due to a lack of formal monitoring studies). Meanwhile, the car club literature emphasises the benefits of a positive approach, and the value of having organisations to represent car clubs as one way of achieving better engagement with decision makers.

6.4.3 Marketing, parking, access and pick-up points

In relation to practical assistance, four areas emerged as being perhaps the most important ways in which local authorities can support schemes.

The first relates to **marketing**. In the same way that decision-makers may not be aware of, or understand, the nature of initiatives being offered, the same is true for the general public, and people are highly unlikely to get involved in new initiatives if they do not know what they are being offered. Hence, one key way in which government can encourage schemes is to help in publicising and explaining them, and providing appropriate endorsement. (There is now evidence from the 'Smarter Travel' work in the London boroughs of Sutton and Richmond to show the effectiveness of promotional work in relation to car clubs.) In our case studies, Avego particularly emphasised this role. Meanwhile, this is also emphasised in the car club literature – where on-street lines and signs are seen as beneficial partly for their awareness-raising potential. It is interesting that schemes such as car2go and SuperShuttle use particularly distinctive vehicles, which act as a form of marketing in themselves. It is also likely that local authorities will be able to play a key role in facilitating appropriate integration between schemes and more conventional public transport operations, which, alongside other potential benefits, can have an important promotional effect.

Second, **access rights** may be a key way in which authorities can help or hinder schemes. HOV lanes are a form of access control – and levels of enforcement (currently the responsibility of the police in the UK) can also be a key factor in their success. Decisions about whether vehicles in schemes can make use of bus lanes, whether they are exempt from charges or tolls (such as the London Congestion Charging scheme), and where they are licensed to operate can all affect their scale and attractiveness. For example, SuperShuttle reports on operational restrictions in Stockholm.

Third, it is clear that **parking provision** is a key way in which authorities can help in encouraging different options – which can take the form of providing designated spaces, parking rights, cheaper spaces or free spaces for vehicle rental schemes; providing spaces that are desirable for car sharers (due to location, pricing, or even via barrier-controlled car parks); providing parking opportunities for those who wish to share rides, where they can meet up (and leave a vehicle); or providing appropriate waiting and drop-off parking at key origins and destinations for shared-taxi schemes.

Fourth, a feature of both ride-sharing schemes and shared-taxi schemes is the use of **pick-up and drop-off points**. Whilst some provision of such locations is obviously commonplace for mainstream taxi operations in the UK, it is interesting to note that schemes abroad may offer a much greater number of points, and that they are also being offered in association with ride sharing. For example, the Belgian shared-taxi company Collecto operates using 200 specifically designated night-time pick-up points, and the Canadian shared Taxibus service operates using 300 designated pick-up/drop-off points. Slugging only works because of designated pick-up points (which are often specified in locations which also serve public transport); park-and-pool schemes are effectively pick-up points; the van-pooling literature reports that, whilst some people sharing are picked up from their home, others wait to be picked up at an appropriate location. Avego reports that they operate on a mixture of formal and informal pick-up points. To our knowledge, aside from one small-scale experiment in South Gloucestershire, there has been very little consideration of providing such opportunities in the UK, and this might be worthy of further consideration. For example, these could range from park-and-pool facilities at motorway service stations, through to officially designated rendezvous points on busy city arterial roads, as they pass through residential areas.

6.4.4 Regulation and taxation

Regulation and taxation both emerge as major ways in which government can support or, conversely, undermine schemes. This report has not been able to undertake a comprehensive review of the issues. However areas which have emerged include:

Vehicle licensing and taxation – for example, in relation to van pooling, Enoch notes that, on the one hand, the need for a special licence to drive a vehicle

with more than eight seats is a constraint in the UK which does not exist in the USA, and that, on the other hand, a driver using a smaller vehicle would be taxed as if they had received a company car. Equally, CfIT noted that taxi companies wishing to offer shared services would still incur VAT (given their small vehicles), and would not be eligible for various forms of financial support available to other public transport providers.

Insurance – in California, a number of shared-ownership schemes (including three peer-to-peer rental schemes) seem to have benefited from Assembly Bill 1871, which has clarified the insurance implications of sharing vehicles. Meanwhile, concerns about insurers are reported in relation to van-pooling schemes, and were also raised by Avego.

Charging – SuperShuttle highlights that its operations depend on being able to charge individuals separately for use of a shared service. Equally, the amount that drivers in the Avego scheme can charge is capped by tax regulations.

Access and parking – access and parking can be key ways in which a local authority can help or hinder particular schemes, as discussed in the previous section.

Regulatory levels – both the CfIT's report on shared taxis and the recent House of Commons Transport Committee report on taxi and private hire vehicle legislation identify problems with the way in which taxis are currently regulated at district / unitary authority level in the UK.

6.5 Integration between transport options

There are various examples where organisations are forming partnerships for mutual benefit. For example:

- SprideShare, a peer-to-peer rental scheme in the USA, has links to City CarShare, a car club with 13,000 screened members.
- Zimride and Zipcar provide a joint offering to enable people to both book cars and share lifts through a single process.
- car2go has a formal joint venture in place with rental company Europcar (with local joint ventures in specific locations).

There are also various examples where alternative car options are linking with public transport. For example, shared-taxi schemes SuperShuttle, Connexxion and PubliCar are all run by public transport operators; LeasePlan in the Netherlands offers its Mobility Mixx service, providing lease drivers with a range of options; and numerous car clubs have positive arrangements with public transport providers in place.

However, it is also clear that there are likely to be situations where services are in competition. For example, at airports, shared-taxi schemes and conventional rental will inevitably vie for customers (though it is unclear whether they will appeal to different people or be attracting the same people). Equally, the nature of the relationship between some of these schemes and public transport is crucial for an understanding of overall environmental impacts. Apart from some positive evidence reported in relation to collaborative arrangements with car clubs, and some positive arrangements between shared-taxi services and public transport operators, this study has uncovered little additional information to that reported in the previous study.

Hence, as in the previous study, it seems that one priority could be to develop a properly evaluated trial of all of the alternative car options. This might include the development of collaborative relationships between all of the providers, and with a public transport operator, and perhaps the creation of a range of joint services, potentially building on some of the partnerships that are already emerging.

6.6 Evaluation evidence and future research priorities

As outlined above, in most areas the amount of evaluation evidence available to assess the impacts of these types of schemes is remarkably limited.

The one area where we feel that further assessment of the literature would be of value is in relation to car clubs. During the study, we came across both overview papers and individual reports relating to car club impacts. We feel that a detailed synthesis of this information – including correspondence with individual clubs in order to gain considerably more information about the survey basis for many of the reported results – would be a valuable exercise in increasing understanding about what is and is not known, and the ways in which information is currently being generated.

Otherwise, a clear priority seems to be further evaluation activity – i.e. new primary research into the impacts of many of the individual schemes reported here (possibly as part of the proposed trial described in the previous section).

We also feel that the correspondence relating to the case study schemes reported here was particularly useful, and that a more extensive programme of engagement with scheme providers could provide more detailed insights into the factors determining whether schemes are a success, the policy mechanisms needed to support them, and the ways in which providers expect to see them developing in the future.

7 References

Given the large amount of website material used, the references for this report have been grouped by topic area, to make it easier to find the sources of information relevant to the different types of initiative, or specific schemes, discussed.

The websites in this report were consulted mainly in June/July 2011, and the information quoted from them is valid as of that time.

The reference for the RAC Foundation think piece that preceded this study, and which focused on UK experience in this area, is:

Cairns, S. (2011a). *Accessing cars: Different ownership and use choices.* Retrieved 29 November 2011 from www.racfoundation.org/assets/rac_foundation/content/downloadables/accessing_cars-cairns-main_report.pdf.

An index of the other references is provided below. It generally follows the structure of the main report.

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- TreinTaxi
- PubliCar
- Regiotaxi
- Taxibus
- TAXiTUB
- Anruf-Sammel-Taxis (Germany)
- Collecto
- AST (Linz)

Vehicle rental / drive-yourself solution

Conventional rental

General references

Cairns, S. (2011b). *Vehicle rental: environmental and sustainability implications*. TRL PPR583. Report to the British Vehicle Rental and Leasing Association (BVRLA).

Eltis (2011). *12% more kilometres travelled with Dutch Mobility Card*. Retrieved 30 November 2011 from www.eltis.org/index.php?ID1=5&id=60&news_id=2465.

Hertz (2011). *Hertz helps Londoners get on their electric bikes in car rental industry first*. Press release, 6 June 2011. Retrieved 30 November 2011 from www.hertz.co.uk/rentacar/abouthertz/index.jsp?targetPage=pressWireView.jsp&leftNavUserSelection=globNav_9_3.

Scheme-specific references

LeasePlan
Website: www.leaseplan.nl/english

Mobility Mixx
Website: www.mobilitymixx.nl

Car clubs

General references

Clavel, R., Mariotto, M. & Enoch, M. P. (2009). *Carsharing in France: past, present and future*. Paper for 88th annual meeting of the TRB. Washington DC: Transportation Research Board.

Enoch, M. P. & Taylor, P. (2006). A worldwide review of support mechanisms for car clubs. *Transport Policy*, 13: 434–43.

Goodwin, P. B. (1988). Circumstances in which people reduce car ownership – a comparative analysis of three panel data sets. *IATSS Research*, 12(2): 60–65.

Harmer, C. & Cairns, S. (2011). *Carplus annual survey of car clubs 2010/11*. Crowthorne: Transport Research Laboratory.

Innovative Mobility Research (2011). *Carsharing*. Retrieved 30 November 2011 from www.innovativemobility.org/carsharing/index.shtml.

KonSULT (2011). *Car clubs*. Retrieved 30 November 2011 from www.konsult.leeds.ac.uk/private/level2/instruments/instrument005/l2_005summ.htm.

Litman, T. (1999). Evaluating Carsharing Benefits. Victoria, BC: Victoria Transport Policy Institute.

Martin, E., Shaheen, S. A. & Lidicker, J. (2010). Impact of Carsharing on Household Vehicle Holdings. *Journal of the Transportation Research Board*, 2143: 150–58.

Martin, E. W. & Shaheen, S. A. (2010). *Greenhouse gas emission impacts of carsharing in North America*. San Jose, CA: Mineta Transportation Institute.

Millard-Ball, A., Murray, G., Ter Schure, J., Fox, C. & Burkhardt, J. (2005). *Car-sharing: How and where it succeeds*. TCRP Report 108. Washington DC: Transportation Research Board.

moses (2005). *The Moses guide: keys to car sharing*. European project report.

Shaheen, S. A. & Cohen, A. P. (2007). Growth in worldwide carsharing: an international comparison. *Journal of the Transportation Research Board*, 1992: 81–89.

Shaheen, S. A., Cohen, A. P. & Chung, M. S. (2009). North American Carsharing: 10 year retrospective. *Journal of the Transportation Research Board*, 2110: 35–44.

TDM Encylopedia (2011). *Carsharing*. Retrieved 30 November 2011 from www.vtpi.org/tdm/tdm7.htm.

Zhao, D. (2010). *Carsharing: A Sustainable and Innovative Personal Transport Solution with Great Potential and Huge Opportunities*. Frost & Sullivan Automotive Practice Report. Retrieved 30 November 2011 from www.frost.com/prod/servlet/market-insight-top.pag?docid=190795176.

Scheme-specific references

Mobility
Website: www.mobility.ch/en

Eltis (2009). *Click & Drive – Your hire car at the railway station (Switzerland)*. Retrieved 30 November 2011 from www.eltis.org/index.php?id=13&study_id=2097.

Eltis (2010). *Mobility CarSharing Switzerland – Cars that move me (Switzerland)*. Retrieved 30 November 2011 from www.eltis.org/index.php?id=13&study_id=2667.

Zipcar
Website: www.zipcar.com

In Wikipedia: http://en.wikipedia.org/wiki/Zipcar

Eltis (2011). *Carsharing system Zipcar goes public*. Retrieved 30 November 2011 from www.eltis.org/index.php?ID1=5&id=60&news_id=2504.

Communauto

Website: www.communauto.com/index_ENG.html

In Wikipedia: http://en.wikipedia.org/wiki/Communauto

Communauto (2011a). *Communauto to introduce one way car sharing in Quebec*. Retrieved 30 November 2011 from www.communauto.com/communiques/2011/LSI/index_eng.html.

Communauto (2011b). *Electric vehicles for our members beginning in the summer of 2011*. Retrieved 30 November 2011 from www.communauto.com/electrique/index_ENG.html.

Communauto (2011c). *First study on car-sharing in Québec*. Retrieved 30 November 2011 from www.communauto.com/premiereetude_ENG.html.

Green Wheels
Website [Netherlands]: www.greenwheels.com/nl/Home/Particulieren/Home.html [Dutch to English using Google translate, although full site would not translate]

Website [Germany]: www.greenwheels.de

Borguis, J. (2010). *Greenwheels*. Presentation by Jan Borguis, Carplus Conference 2010. Retrieved 30 November 2011 from www.carplus.org.uk/wordpress/carplus-annual-conference.

Use of lower carbon vehicles

General references

AutoblogGreen (2010). *Europcar pre-orders 500 electric vehicles from Renault, coming to rental fleets in 2011*. Retrieved 30 November 2011 from http://green.autoblog.com/2010/03/04/europcar-pre-orders-500-electric-vehicles-from-renault-coming-t/.

Avis (2011). *Avis pre-orders 500 Renault electric vehicles for hire*. Press release, n.d. Retrieved 30 November 2011 from www.avis.co.uk/AvisPress/12-Avis-pre-orders-500-electric-vehicles.

Eltis (2010a). *Eco-friendly car sharing service at regional rail stations in Lombardy (Italy)*. Retrieved 30 November 2011 from www.eltis.org/index.php?ID1=5&id=8&news_id=2235.

Eltis (2010b). *Electric recharging stations for car sharing in Milan (Italy)*. Retrieved 30 November 2011 from www.urbantransport.eu/index.php?ID1=5&id=8&news_id=2225.

Eltis (2010c). *Sunfleet Gothenburg – 37 sharing pools using environmental friendly cars only (Sweden)*. Retrieved 30 November 2011 from www.eltis.org/index.php?id=13&study_id=2574.

Eltis (2011a). *Brussels tries self-service electric cars (Belgium)*. Retrieved 30 November 2011 from www.eltis.org/index.php?IDI=5&id=60&news_id=2473.

Eltis (2011b). *E-sharing project in Spain promotes electric cars*. Retrieved 30 November 2011 from www.eltis.org/index.php?ID1=5&id=60&news_id=2467.

Eltis (2011c). *Large fleet of electric cars for rental company (France)*. Retrieved 30 November 2011 from www.eltis.org/index.php?IDI=5&id=60&news_id=2380.

Eltis (2011d). *Nice to launch an electric car-sharing scheme (France)*. Retrieved 30 November 2011 from www.eltis.org/index.php?ID1=5&id=8&news_id=2241.

Eltis (2011e). *Pilot project of electric shared cars (Belgium, Netherlands)*. Retrieved 30 November 2011 from www.eltis.org/index.php?ID1=5&id=8&news_id=2337.

Gallucci, M. (2011). *Auto industry pins hope on fleets to charge America's electric car market*. Retrieved 30 November 2011 from http://insideclimatenews.org/news/20110911/auto-industry-nissan-leaf-chevy-volt-fleet-operators-fedex-electric-cars-charging.

Loveday, E. (2009). *Better place experimenting with EV car sharing at train*

stations. Retrieved 30 November 2011 from www.allcarselectric.com/news/1037222_better-place-experimenting-with-ev-car-sharing-at-train-stations.

Mobilie Cités (2011). *Very Nice electric carsharing system*. Retrieved 30 November 2011 from www.mobilicites.com/en_news-very-nice-electric-carsharing-system_77_894.html.

Renault (2011). *Hertz and Renault partner to bring electric vehicles to European rental markets*. Press release, 2 March. Retrieved 30 November 2011 from www.media.renault.com/global/en-gb/renaultgroup/Media/PressRelease.aspx?mediaid=27882.

Zax, D. (2011). *Car sharing goes all-electric in Brussels*. Fast Company News, 24 February. Retrieved 30 November 2011 from www.fastcompany.com/1731321.

City car hire schemes

Scheme-specific references

Autolib'
Website [France]: www.autolib-paris.fr

Chrisafis, A. (2008). *Paris plans help-yourself green car hire*. The Guardian, 20 June. Retrieved 30 November 2011 from www.guardian.co.uk/world/2008/jun/20/france.travelandtransport.

Eltis (2011). *Autolib' self service electric cars launched in Paris*. Retrieved 30 November 2011 from www.eltis.org/index.php?ID1=5&id=60&news_id=2472.

Liu, L. (2009). *Autolib': Paris' Electric Car Sharing Plan*. Bloomberg Business Week, 7 August. Retrieved 30 November 2011 from www.businessweek.com/globalbiz/content/aug2009/gb2009087_330677.htm.

Massy-Beresford, H. (2010). *Paris Autolib' electric car hire scheme accelerates*. Reuters, 16 December. Retrieved 30 November 2011 from www.reuters.com/article/2010/12/16/us-cars-electric-paris-idUSTRE6BF21T20101216.

Sustainable Mobility (2010). *Autolib' chooses Bluecar*. Retrieved 30 November 2011 from www.sustainable-mobility.org/news/news-feed/autolib-chooses-bluecar.html.

The Times (2008). *Paris offers drivers electric cars to beat pollution – for a small charge*. Retrieved 30 November 2011 from www.timesonline.co.uk/tol/driving/news/article3118755.ece.

car2go

Website [Main]: www.car2go.com/

Website [Ulm Scheme]: www.car2go.com/ulm/en

Website [Austin Scheme]: www.car2go.com/austin/en

Website [Hamburg Scheme]:www.car2go.com/hamburg/de

Website [Vancouver Scheme]: http://car2govancouver.com

In Wikipedia: http://en.wikipedia.org/wiki/Car2Go

Austin Business Journal (2011). *Smart sharing*. Retrieved 30 November 2011 from www.bizjournals.com/austin/print-edition/2011/01/28/smart-sharing.html.

AutoblogGreen (2010a). *Car2go, the Fortwo car-sharing service, moves into Vancouver, BC for tests*. Retrieved 30 November 2011 from http://green.autoblog.com/2010/08/20/car2go-the-forwo-car-sharing-service-moves-into-vancouver-bc/.

AutoblogGreen (2010b). *car2go Austin celebrates one-year anniversary; expansion coming soon*. Retrieved 30 November 2011 from http://green.autoblog.com/2010/11/21/car2go-austin-celebrates-one-year-anniversary-expansion-coming/.

AutobloGreen (2010c). *Daimler and Europcar bring Car2go car-sharing service to Hamburg, Germany*. Retrieved 30 November 2011 from http://green.autoblog.com/2010/10/19/daimler-and-europcar-bring-car2go-car-sharing-service-to-hamburg/.

Eltis (2011a). *Amsterdam car sharing system uses electric vehicles*. Retrieved 30 November 2011 from www.eltis.org/index.php?ID1=5&id=60&news_id=2496.

Eltis (2011b). *Unlimited parking car club launched in Hamburg*. Retrieved 30 November 2011 from www.eltis.org/index.php?ID1=5&id=60&news_id=2491.

Firnkorn, J. & Müller, M. (2011). What will be the environmental effects of new free-floating car-sharing systems? The case of car2go in Ulm. *Ecological Economics*, 70(8): 1519–28.

Morrison-Jones, T. (2011). *Introducing car2go*. Presentation given at Carplus Conference 2011. Retrieved 30 November 2011 from www.carplus.org.uk/wordpress/wp-content/uploads/2011/05/Tom_Morrison-Jones_Carplus_Annual_Conference_2011.pdf.

Statesman (2011). *Car2Go adding vehicles, expanding service area in Austin*. Retrieved 30 November 2011 from www.statesman.com/business/car2go-adding-vehicles-expanding-service-area-in-austin-1305254.html.

DriveNow
BMW Blog (2011). *DriveNow: BMW and Sixt joint venture for premium car sharing*.. Retrieved 1 December 2011 from www.bmwblog.com/2011/03/21/bmw-and-sixt-establish-drivenow-joint-venture-for-premium-car-sharing/.

BMW i UK (2011). *BMW Group and Sixt AG launch DriveNow*. Retrieved 1 December 2011 from www.bmw-i.com/en_ww/experience-bmw-i/#bmw-group-and-sixt-ag-launch-drivenow.

ZebraMobil
Website [Germany]: www.zebramobil.de

Peer-to-peer car rental schemes

General references

In Wikipedia: http://en.wikipedia.org/wiki/Peer-to-peer_car_rental

Garthwaite, J. (2011). *Car sharing start ups bask in Zipcar's I.P.O. Glow*. The New York Times, 14 April. Retrieved 30 November 2011 from http://wheels.blogs.nytimes.com/2011/04/14/car-sharing-start-ups-bask-in-zipcars-i-p-o-glow/.

O'Neill, S. (2011). *In Bay Area, new Peer-to-Peer car sharing offers*. The New York Times, 2 February. Retrieved 30 November 2011 from http://intransit.blogs.nytimes.com/2011/02/02/in-bay-area-new-peer-to-peer-car-sharing-offers/.

Scheme-specific references

Relay Rides
Website: http://relayrides.com

In Wikipedia: http://en.wikipedia.org/wiki/Peer-to-peer_car_rental

Frean, A. (2010). *The start-up that's putting the social network generation in the driving seat*. The Times, 30 December. Retrieved 30 November 2011 from www.collaborativeconsumption.com/buzz-and-press/Times%20of%20London,%2012.30.2010.pdf.

Levy, A. (2010a). *Google-Backed RelayRides Lets Vehicle Owners Rent Cars for Cash*. Bloomberg, 14 December. Retrieved 30 November 2011 from www.

bloomberg.com/news/2010-12-14/google-backed-relayrides-lets-users-rent-cars-for-cash-taking-on-zipcar.html.

Levy, A. (2010b). *Zipcar competitor RelayRides comes to S.F.* The San Francisco Chronicle, 14 December. Retrieved 30 November 2011 from http://sfgate.com/cgi-bin/article.cgi?f=/c/a/2010/12/14/BUE41GQ05A.DTL.

Lynley, M. (2010). *Google drops bank in RelayRides to turn your car into a Zipcar*. The New York Times, 14 December. Retrieved 30 November 2011 from www.nytimes.com/external/venturebeat/2010/12/14/14venturebeat-google-drops-bank-in-relayrides-to-turn-your-6452.html?partner=rss&emc=rss.

Getaround
Website: www.getaround.com

In Wikipedia: http://en.wikipedia.org/wiki/Peer-to-peer_car_rental

SprideShare
Website: http://spride.com/

In Wikipedia: http://en.wikipedia.org/wiki/Peer-to-peer_car_rental

Carpenter, S. (2010). *Got a car? Personal-vehicle sharing comes to California in 2011*. Los Angeles Times, 6 October. Retrieved 1 December 2011 from http://latimesblogs.latimes.com/greenspace/2010/10/spride.html.

Spride (2010). *U.C. Berkeley Survey on Personal Car Sharing Preliminary Results*. Retrieved 30 November 2011 from http://sprideshare.posterous.com/uc-berkeley-survey-on-personal-car-sharing-pr.

Schwartz, A. (2010). *Californians get to rent their cars to strangers*. Fast Company, 30 September. Retrieved 30 November 2011 from www.fastcompany.com/1692396/spride-share-lets-californians-rent-out-personal-cars.

Drive My Car Rentals
Website: www.drivemycarrentals.com.au

In Wikipedia: http://en.wikipedia.org/wiki/Peer-to-peer_car_rental

Hammond, M. (2011). *Domenic Carosa takes the wheel with DriveMyCarRentals*. Smart Company, 13 May. Retrieved 1 December 2011 from www.smartcompany.com.au/start-up/20110513-domenic-carosa-takes-the-wheel-with-drivemycarrentals.html.

RentMyCar
Website: None found

In Wikipedia: http://en.wikipedia.org/wiki/Peer-to-peer_car_rental

tamyca
Website [Germany]: www.tamyca.de

Livop
Website [France]: www.livop.fr

Lift-sharing / drive-sharing solutions

General references

In Wikipedia: http://en.wikipedia.org/wiki/Carpool

Chan, N. D. & Shaheen, S. A. (2011). *Ridesharing in North America: past, present and future*. Transportation Research Board Annual Meeting. Retrieved 1 December 2011 from http://amonline.trb.org/12kqrp/12kqrp/1.

Clabburn, A. (2011). Personal correspondence.

DfT (Department for Transport) (2009). *Transport Statistics Bulletin – National Travel Survey: 2008*. London: Department for Transport.

Hutchins, R. & Binsted A (2012). *The role of social networking sites in changing travel behaviours*. Crowthorne: Transport Research Laboratory.

ITP with Richard Armitage Transport Consultancy, Cleary Hughes Associates & Austin, J. (2004). *Making car sharing and car clubs work*. London: Department for Transport.

KonSULT (2011). *Ride sharing*. Retrieved 1 December 2011 from www.konsult.leeds.ac.uk/private/level2/instruments/instrument003/l2_003summ.htm.

liftshare (2010) – data as reported in Cairns, S. (2011a). *Accessing cars: different ownership and use choices*. London: RAC Foundation.

MIT (Massachusetts Institute of Technology) (2011). *MIT "Real-Time" Rideshare Research*. Department of Civil & Environmental Engineering. Retrieved 1 December 2011 from http://ridesharechoices.scripts.mit.edu/home/.

TDM Encylopedia (2011). *Ridesharing*. Retrieved 1 December 2011 from www.vtpi.org/tdm/tdm34.htm.

Matching schemes

Scheme-specific references

PickupPal
Website: www.pickuppal.com

Zimride
Website: www.zimride.com

Mitfahrzentrale
Website: www.mitfahrzentrale.de

Covoiturage
Website: www.covoiturage.fr

Comuto
Website: www.comuto.es

GoLoco
Website: www.goloco.org

gtrot
Website: www.gtrot.com

NuRide
Website: www.nuride.com

High-occupancy vehicle lanes

General references

In Wikipedia – 'Transit lane': http://en.wikipedia.org/wiki/Transit_lane

DfT (Department for Transport) (2010). *Transport secretary suspends M4 bus lane to benefit all road users*. Press Release, 4 October. Retrieved 1 December 2011 from www.dft.gov.uk/news/press-releases/dft-press-20101004b.

Kwon, J. & Varaiya, P. (2008). Effectiveness of California's High Occupancy Vehicle (HOV) system. *Transportation Research Part C*, 16(1): 98–115.

TDM Encylopedia (2011). *HOV Priority*. Retrieved 1 December 2011 from www.vtpi.org/tdm/tdm19.htm.

TRL (Transport Research Laboratory) (2002). *Current Topics in Transport: High Occupancy Vehicle Lanes Update 2000–2002*. Crowthorne: TRL.

TRL (2008). *Current Topics in Transport: Managed Vehicles Lanes: Update 2003–2008*. Crowthorne: TRL.

Turnbull, K. F. (2005). *HOV and HOT Lanes in the United States*. Paper for the European Transport Conference. Retrieved 1 December 2011 from www.etcproceedings.org/paper/hov-and-hot-lanes-in-the-united-states.

Turnbull, K. F., Levinson, H. S. & Pratt, R. (2006). *Traveler response to transportation system changes*. Chapter 2 – HOV facilities. Transit Cooperative Research Program, Report 95. Washington DC: Transportation Research Board.

US Department of Transportation (2011). *HOV Clearing House*. Federal Highway Administration. Retrieved 1 December 2011 from http://arcims.urscorp.com/HOV/index.asp.

Slugging

General references

In Wikipedia: http://en.wikipedia.org/wiki/Slugging

In Washington DC: www.slug-lines.com

In San Francisco: www.ridenow.org/carpool

Badger, E. (2011). *Slugging – The People's Transit*. Miller-McCune, 7 March. Retrieved 1 December 2011 from www.miller-mccune.com/culture-society/slugging-the-peoples-transit-28068.

Burris, M. W. & Winn, J. R. (2006). Slugging in Houston – Casual carpool passenger characteristics. *Journal of Public Transportation*, 9(5): 23–40.

Mote, J. E. & Whitestone, Y. (2011). The social context of informal commuting: Slugs, strangers and structuration. *Transportation Research Part A: Policy and Practice*, 45(4): 258–68.

Van pooling

General references

In Wikipedia: http://en.wikipedia.org/wiki/Vanpool

Eltis (2007a). *Ride-on Transportation Management Association (California)*. Retrieved 1 December 2011 from www.eltis.org/index.php?id=13&study_id=1302.

Eltis (2007b). *Vanpooling: commuting in a minibus (region Flevoland-Amsterdam, the Netherlands)*. Retrieved 1 December 2011 from www.eltis.org/index.php?id=13&study_id=1575.

Enoch, M. P. (2003). Pooling together: why the vanpool works in the USA and the Netherlands. *Traffic Engineering and Control*, 44(1): 12–14.

Evans, J. E. & Pratt, R. (2005). *Traveler response to transportation system changes*. Chapter 5 – vanpools and buspools. Transit Cooperative Research Program, Report 95. Washington DC: Transportation Research Board.

Mielke, J. (2006). *Vanpooling in North Dakota: Feasibility and Operating Scenarios*. Prepared for North Dakota Department of Commerce and State Energy Office, Division of Community Services. Retrieved 1 December 2011 from www.ugpti.org/pubs/pdf/DP174.pdf.

Scheme-specific references

King County Metro's Commuter Van Programme
Website: http://metro.kingcounty.gov/tops/van-car/commutervans.html

Enterprise Rideshare
Website: www.vanpool.com

Easy Street
Website: www.easystreet.org

VPSI
Website: www.vpsi.org

Avego (2009). *Avego Powers VPSI Vanpooling*. Retrieved 1 December 2011 from www.avego.com/newsletters/newsletter14/index.html.

Vipre
Website: www.vipre.nl

Sharer parking / park-and-pool

General references

DeGruyter, C. (2006). *Investigating a CBD-wide carpooling scheme for Melbourne*. Report for the 29th Australasian Transport Research Forum. Retrieved 1 December 2011 from www.transport.vic.gov.au/__data/assets/pdf_file/0015/31218/060620cd-Investigating-a-CBD-wide-carpooling-scheme-for-Melbourne-Paper.pdf.

Filosa, G. (2006). *Carsharing: establishing its role in the parking demand management toolbox*. Thesis submitted to Tufts University. Retrieved 1 December 2011 from www.vtpi.org/filosa_carsharing.pdf.

Rose, G. (2002). Providing premium carpool parking using a low-tech ITS initiative. *ITE Journal*, 72(7): 32–36.

Shaheen, S. A., Cohen, A. P. & Martin, E. (2010). Carsharing Parking Policy: Review of North American Practices and San Francisco, California, Bay Area Case Study. *Journal of the Transportation Research Board*, 2187: 146–56.

Shaheen, S. A., Rodier, C., Murray, G., Cohen, A. & Martin, E. (2010). *Carsharing and public parking policies: assessing benefits, costs and best practices in North America*. MTI Report 09-09. Retrieved 1 December 2011 from http://76.12.4.249/artman2/uploads/1/2612_Carsharing-Parking_1.pdf.

Turnbull K. F., Pratt R. H. & Evans J. E. (2004). *Traveler response to transportation system changes*. Chapter 3 – park-and-ride/pool. Transit Cooperative Research Program, Report 95. Washington DC, Transportation Research Board.

Dynamic ride sharing

General references

In Wikipedia: http://en.wikipedia.org/wiki/Dynamic_ridesharing

Eltis (2010). *Instantaneous car-pooling via cell phone (France)*. Retrieved 1 December 2011 from www.eltis.org/index.php?idi=5&id=60&news_id=2174.

Carticipate website: http://carticipate.com

Scheme-specific references

Avego
Website: www.avego.com/

AvegoVideos YouTube Channel: www.youtube.com/avegovideos

Avego (2011a). *Avego Pilot at UCC*. Retrieved 1 December 2011 from www.avego.com/st/ucc.php.

Avego (2011b). *Bergen, Norway chooses Avego for Real-time Ridesharing Pilot*. Retrieved 1 December 2011 from www.avego.com/newsletters/newsletter28/index.html.

Avego (2011c). *Real-time ridesharing launches on SR 520 to save commuters time and money*. Press Release, 27 January. Retrieved 1 December 2011 from www.avego.com/common/press/releases/go520_Press_Release.pdf.

Avego (2011d). *The Buzz*. Retrieved 1 December 2011 from www.avego.com/st/buzz.php.

Lindblom, M. (2011). *Click to share a ride and toll on the 520*. Seattle Times, 27 January. Retrieved 1 December 2011 from http://o.seattletimes.nwsource.com/html/localnews/2014060417_eslugging28m.html.

Taxis / expert driver solutions

Shared-taxi schemes

General references

TDM Encylopedia (2011a). *Shuttle Services*. Retrieved 1 December 2011 from www.vtpi.org/tdm/tdm39.htm.

TDM Encylopedia (2011b). *Taxi Service Improvements*. Retrieved 1 December 2011 from www.vtpi.org/tdm/tdm78.htm.

CfIT (Commission for Integrated Transport) (2008). *A new approach to rural transport*. London: Commission for Integrated Transport.

Cooper, J., Mundy, R. & Nelson, J. (2010). *Taxi! Urban economies and the social and transport impacts of the taxicab*. Farnham: Ashgate Publishing Ltd.

Enoch, M., Potter, S., Parkhurst, G. & Smith, M. (2004). *INTERMODE: Innovations in Demand Responsive Transport. Report to the Department for Transport and the Greater Manchester Passenger Transport Executive*. Retrieved 1 December 2011 from http://design.open.ac.uk/potter/documents/INTERMODE.pdf.

House of Commons Transport Committee (2011). *Taxis and private hire vehicles: the road to reform*. *Seventh report of session 2010–12*. London: The Stationery Office.

Mott MacDonald (2008). *The role of taxis in rural public transport: final report*. London: Commission for Integrated Transport.

Mulley, C. & Nelson, J. D. (2009). Flexible transport services: a new market opportunity for public transport. *Research in Transportation Economics*, 25: 39–45.

Nutley, S.D. (1990). *Unconventional and community transport in the United Kingdom*. London: Gordon and Breach Science Publishers.

Scheme-specific references

SuperShuttle
Website [Main]: www.supershuttle.com
Website [France]: www.supershuttle.fr
Website [Sweden]: www.supershuttle.se

Prime Time Shuttle
Website: www.primetimeshuttle.com/index.html

Hitchsters
Dennis, K. & Urry, J. (2009). *After the car*. Cambridge: Polity Press.
Website: www.hitchsters.com

Connexxion
In Wikipedia: http://en.wikipedia.org/wiki/Connexxion
Website [Main]: www.connexxion.nl/
Website: www.connexxion.nl/wat_is_cvv-vervoer_/106/
Website: www.connexxion.nl/wat_is_wmo-vervoer_/107/

TreinTaxi
CfIT (Commission for Integrated Transport) (2008). *A new approach to rural transport*. London: Commission for Integrated Transport.

The Official Site of Holland (2011). *Getting Around: Train Taxi, Tourist Holland*. Retrieved 1 December 2011 from www.holland.com/uk/gettingthere/around/train/traintaxi.jsp.

PubliCar
Website: www.postauto.ch/en/pag-startseite/pag-taeglich-unterwegs/pag-fahrplan-und-linienverkehr/pag-publicar-angebot.htm

Bührmann, S. (2005). *PubliCar: 'Call a bus' service in Switzerland*. Retrieved 2 December from

www.osmose-os.org/documents/25/CaseStudyPubliCar(CH)2.pdf.

CfIT (Commission for Integrated Transport) (2008). *A new approach to rural transport*. London: Commission for Integrated Transport.

Regiotaxi
Website [Area Scheme]: www.tcr.nl/regiotaxi-salland
Website [Area Scheme]: http://regiotaxi.haaglanden.nl/#pagina=849

Website [Area Scheme]: www.regiotaxitwente.nl/
Website [Area Scheme]: www.stadsregiotaxi.nl/

CfIT (Commission for Integrated Transport) (2008). *A new approach to rural transport*. London: Commission for Integrated Transport.

Mulley, C. & Nelson, J. D. (2009). Flexible transport services: a new market opportunity for public transport. *Research in Transportation Economics*, 25: 39–45.

Taxibus
Website: www.ville.rimouski.qc.ca/webconcepteur/web/VilledeRimouski/en/citoyens/nav/circulation/Rimouskibus.html?iddoc=188156

Dufour, J. (2004). *Taxibus: Public transportation for smaller cities*. Retrieved 1 December 2011 from www.tc.gc.ca/media/documents/programs/cs06e_taxibus.pdf.

TAXiTUB
Website [Area Scheme]: www.saintbrieuc-agglo.fr/fr/taxitub/taxitub.php
Website [Area Scheme]: www.tubinfo.fr/les-tub/taxitub,50.html

CfIT (Commission for Integrated Transport) (2008). *A new approach to rural transport*. London: Commission for Integrated Transport.

Anruf-Sammel-Taxis (Germany)

Website [Area Scheme]: www.ewf.de/oepnv/ast/ast.htm

Website [Area Scheme]: www.hvv.de/fahrplaene/verkehrsangebot/anruf-sammeltaxi-bus/

CfIT (Commission for Integrated Transport) (2008). *A new approach to rural transport*. London: Commission for Integrated Transport.

Collecto
Website: www.taxisverts.be/?cat=130&lang=en

Dufour, D. (2008). *Shared taxis in Brussels: the missing link in urban transport?* Retrieved 1 December 2011 from www.urbanicity.org/Site/Articles/Dufour.aspx.

AST (Linz)
Website: www.linzag.at/portal/portal/linzag/privatkunden/mobilittverkehr/anrufsammeltaxi_1/centerWindow;jsessionid=D3606197733EBD757010294C2084D80E.node1?plaginit=1&action=1

Enoch, M., Potter, S., Parkhurst, G. & Smith, M. (2004). *INTERMODE: Innovations in Demand Responsive Transport. Report to the Department for Transport and the Greater Manchester Passenger Transport Executive*. Retrieved 1 December 2011 from http://design.open.ac.uk/potter/documents/INTERMODE.pdf.

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