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The Variable Price and Attribute Transport System

**Stage 3 Report:
Implementation – Opportunities and Barriers**

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Tech4all is a charity devoted to reducing poverty, in particular through the use of technology. It runs a very successful Voicemail for the Homeless scheme (together with the leading homeless charity St Mungo's), used by 700 people in 2006. Tech4all has sponsored this research in order to investigate whether modern technology could create a radical improvement in the availability of high-quality transport services for disadvantaged groups, at low or zero incremental cost to the taxpayer, and in a way which fostered integration of disadvantaged and better-off users."

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Executive Summary

1. The Variable Price and Attribute Transport System (VPATS) is an operating philosophy and technology which proposes a significant increase in system-wide efficiency across the road transport sector through the application of high technology and some changes in practice, whilst at the same time increasing social inclusion by reducing travel poverty. The philosophy seeks to incorporate as many existing assets as possible within the VPATS environment, alongside new market entrants, new types of transport service, and new transport modes.
2. Travel poverty is not solely about limited disposable income and exclusion from the use of transport services on the grounds of price. It is a multifaceted phenomenon, for example also involving the level of disposable time available for travel and the availability of transport services themselves. Households on the lowest incomes in fact make more use of taxis – generally seen as a relatively expensive mode – due to such constraints and lifestyle choices. VPATS seeks to increase the variety of services offered to the travelling public, so should enable individuals to choose solutions closer to their optimum for a specific journey (determined by a range of individually-specified criteria including price). Hence, VPATS has the potential to reduce exclusion whilst bringing wider societal benefits.
3. Market theory suggests that the competitive advantage brought by the introduction of higher technology might be modest, thus making it hard for the technology to break into the marketplace, but this may underplay the importance of higher productivity and the value of more subjective issues such as brand loyalty. In any case, issues such as operator confidence and political support are likely to be at least as important to the success of VPATS as competition.
4. The key practical barriers will include risk aversion amongst operators, which would best be addressed through an effective demonstration by the supplier of the technology, local authority leadership in respect of VPATS within the local policy context, and successful adoption by an ‘early adopter’ operator.
5. The integration requirements between VPATS-coordinated vehicles ought to be reduced due to the greater number of optimum origin-destination solutions offered to individuals. However, the need for interchange may be relatively high during the early history of a system, when it may have less scope in terms of services and limited reach across space. Where interchange remains important, it will need to be high quality to maintain the perceived credentials of the overall system.
6. There are general advantages to the private and public sectors partnering to provide services. In the case of VPATS it is unlikely that a single private sector market player would be able to control sufficient resources, events, and policies to bring about a VPATS implementation alone. The private sector

does, however, offer operating efficiencies and may more often be able to devise innovations, even if not able to deliver them alone.

7. It is envisaged that VPATS will evolve over a period of time, in both terms of modes of operation and scale of operation. A likely starting point is the extension of existing taxi modes into a higher-productivity, shared taxi system. This would not require legislative change, but might be assisted by a shift in taxi licensing from the district tier to a higher level of local government. Vehicles responding to hailed requests would need to be registered as Hackney Carriages rather than Private Hire Vehicles. The shared use of taxis would not normally attract fuel subsidy or VAT exemption under the current regulations. Revision of this situation would clearly assist the financial viability of VPATS.
8. VPATS is likely to be implemented in specific localities first and subsequently spread to other localities, with a possible national network eventually emerging. The initial implementations are likely to require public sector funding, possibly from bids made by local authorities under the Local Transport Plan or Transport Investment Fund mechanisms, with the object of creating a local step-change in public transport provision and modal shift from car. The VPATS service would also create a revenue stream paid by the operators using the system, to the benefit of the local authority, or possibly to repay investment by a private sector partner. This partner might also be one of the operators, unless this is excluded for conflict of interest reasons.
9. A variable pricing system would be required to maintain the system's integrity given peaking in demand, variation in the profitability of the system in space, and to ensure social inclusion objectives are achieved. These arrangements would need to be protected by the licensing conditions to avoid free-riders cherry-picking the more profitable business. To work effectively it may also need regulatory protection from non-VPATS competition, which might exploit market niches and undermine the system from outside. This latter protection may require new legislation unless a requirement to comply with VPATS can be written into local taxi licensing regulations.
10. At a later stage of operation, bus operators are expected to join VPATS. Local authority supported services already operate under contract, and requiring or enabling the use of VPATS for specific contracts would be possible under existing arrangements, and might be an important way of promoting the introduction of the system. However, care will need to be taken not to create unfair competition for commercial services that may operate near the area of service of a VPATS-enabled tendered service.
11. Operating VPATS in an entirely deregulated bus market is likely to be extremely difficult or impossible. On the one hand, it would require a level of coordination of information, fares, and services in a way not legal where the 1985 Transport Act is still the key relevant legislation. On the other hand, as in the case of the taxi market, a coordinated bus service with cross-subsidies would be open to exploitation by competitors. However, the provisions of the Transport Act 2000 and subsequent revisions would enable a local authority to

introduce a quality contract for an operating area, which could include the requirement to take part in a VPATS as a key clause of its specification. There are bureaucratic and legal hurdles to such contracts being introduced, but the facilitating legislation is already in place. Nonetheless, there is growing awareness that competition in the mature bus market is generally weak, and that some of the rationale for the 1985 Act is no longer tenable. Should legislative revision occur, the ideal outcome for VPATS might be the 'quality network' approach, which would be an area-based contract system, with explicit potential for novel entry into the market to be possible, at specific intervals, under specified conditions.

12. In the final analysis, the success of VPATS is likely to depend in great part on the wider transport policy in which it is inserted, and the level of reduction in car use which is achieved by that policy, as this will free highway capacity for VPATS vehicles to operate efficiently. Hence, there are strong synergies between VPATS and road pricing, as the latter might create both more incentive to use VPATS operators' vehicles, whilst creating revenue to fund its operation and repay capital finance arrangements. Where there are boundaries to VPATS operation, care will need to be taken to ensure that any park and ride opportunities provided do not increase car traffic beyond the system boundary in a substantial way.
13. It is concluded that a live trial of VPATS will be essential to convince national government, local representatives and transport operators that it has net benefits to offer. To this end, a local authority might seek demonstration project funding and to introduce a quality contract to protect the integrity of the system area. Exemptions might be sought to specific legislation and subsidy conditions in order to enable a realistic trial ahead of legislative changes. Given the complexities of both the London transport market and two-tier county administrative arrangements a unitary authority might be a relatively straightforward trial area.

1. Introduction

The present report is the product of Stage 3 of a project examining the potential for a Variable Price and Attribute Transport System (VPATS). In ideal, conceptual, terms VPATS is an enabling system made available to existing operators to allow them to offer a radically improved variety and level of service to passengers and local low-bulk deliveries. The system – yet to be specified in detail - involves both information communications technology (ICT) and a pricing system to optimise supply and demand against social and environmental, as well as economic criteria.

Again, in ideal terms, the expectation is that VPATS will be applied across a spectrum of existing modes and operators but perhaps also encourage new market entrants. Hence the market will continue to include conventional (scheduled, fixed-route) bus services, hackney carriage (HC) services and private hire vehicle services (PHV, but also involve new types of service (and perhaps modes¹). Demand responsive transport (DRT) services, for example, already offer flexible transport options in the modal ‘space’ between taxi and bus, and can be expected to further diversify with the support of VPATS.

One example of an optimal outcome from VPATS would be an attribute bundle or ‘virtual mode’ which would provide a level of service equal to or superior² to that of the taxi (and in some respects the private car) at a price closer to current public transport options than current taxi services³. The previous stages of the study have considered the range of attributes that are likely to vary, but to summarise the more important ones here, these will include:

- the extent of pre-booking versus immediacy of availability,
- the extent of sharing versus exclusive use (which will affect journey time and directness as well as more subjective factors such as personal space/privacy, and the
- specification of the vehicle (image, seating quality, air conditioning etc.).

Stage 1 of the overall project examined the opportunities for VPATS in the context of the demand for travel, reaching conclusions based on a review of transport economic literature about the service attribute bundles most likely to attract a complete cross-section of the travelling public.

Stage 2 conducted scenario analysis into possible operating environments, focussing on real-world supply issues, including operating characteristics, infrastructure costs, implications of a range of patronage levels, subsidy requirements and fare levels.

¹ A recent, rare, introduction of an entirely new mode to the UK is the new auto-rickshaw in Brighton, in effect offering a limited, alternative ‘novelty’ bus service but with the potential to compete with other modes. The potential for such a vehicle to offer a taxi service based on a specific attribute bundle (ease of navigation in urban traffic, low cost, basic comfort) in a dense urban area is however clear from international examples.

² The adoption of high-tech scheduling via satellite tracking ought to mean the time between request and the trip beginning is reduced for VPATS over current taxis (although taxi operators may adopt higher technology scheduling in the future in any case, and may achieve similar reductions).

³ In this report the term ‘taxi’ is used to denote both Hackney Carriage and Private Hire Vehicle services.

The scenarios compared and contrasted the enhancement that might be brought by VPATS achieving assumed levels of productivity. The outcomes were presented in terms of patronage levels, operating costs and subsidy levels against the traditional operating performance of the established modes of car, bus, PHV and HC, drawing on a mixture of real-world data and estimations. The scenarios were also constructed in such a way as to indicate a developmental transition, reflecting possible complementary and antagonistic responses from other market players.

These outcomes are placed in the context of diseconomies of scale and relatively high set-up costs for a single-city pioneering scheme; flexible transport systems in countries such as the Netherlands and Turkey now have national coverage – albeit with more regional levels of organisation - and a similar outcome might occur in the UK, with potential to reduce particular costs, for example due to economies of scale in the operation of call centres or the development of software.

Stage 3 completes the work by addressing a key rationale of the study: the practical application of technology to the transport sector in order to reduce travel poverty. Hence, the report briefly reviews the literature on travel poverty, and the role of VPATS in addressing the phenomenon, and then turns to examine the economic-regulatory, political, psychological and practical barriers to implementing the scenarios identified in Stage 2 in such a way as to advantage the travel poor.

2. Travel Poverty

Although the condition of social exclusion cannot be reduced to being synonymous with any of the terms 'deprivation', 'underclass', 'marginalisation' or 'poverty' (Church, Frost & Sullivan, 2000; Social Exclusion Unit, 2003; Kenyon, Lyons & Rafferty, 2002), travel poverty, or lack of access to transport services as a means to access the wider opportunities of society, is presented as a specific, important mechanism within the overall complex. Indeed, some definitions particularly emphasise the spatial basis of exclusion in observing "*a process, which causes individuals or groups, who are geographically resident in a society, not to participate in the normal activities of citizens in that society*" (Gaffron, Hine & Mitchell, 2001: 4).

Church, Frost & Sullivan (2000) in fact identify seven broad types of exclusion: physical, geographical, distance, economic, time-based, fear-based, and spatial. Kenyon, Lyons & Rafferty (2002) have extended this approach, placing mobility exclusion as a particularly important category amongst a total of nine. Their other eight types of exclusion are economic, societal, social network, organised political, personal political, personal, living space and temporal. In addition to influencing access to social and economic opportunity – importantly - mobility exclusion also has the potential to reinforce these other dimensions of exclusion.

Although there are aspirations that 'virtual mobility' and land use planning can, under some circumstances, *reduce the need to travel*, which is the aspiration of UK Government Planning Policy Guidance note PPG13, the principal practical response so far has been the emergence of a new 'industry' around accessibility planning. Local authority Local Transport Plans are required to conduct accessibility audits, particularly for specific travel demands such as access to employment, health care and education. The strategies which then result often emphasise greater public transport as a key supply solution.

There is recognition, however, that traditional public transport solutions are unlikely to be a sufficient answer to addressing travel poverty, most obviously in rural areas, but also at many times and places in urban areas. In considering alternatives, hope has been placed in the development of flexible solutions. To date these have tended to be specific new modal offers, grouped under the banner 'DRT', (Enoch, Potter, Parkhurst, Smith, 2004) and seen as having particular advantages in potentially being superior to both conventional public transport and specialist transport services, such as dial-a-ride services and those used to access health care (DETR, 2000; DfT, 2002; Mageean and Nelson, 2003; Brake, Nelson, and Wright, 2004) and for retired citizens' travel needs (a growing client group) more generally (CAG Consultants and TAS Partnership, 2004).

Specific features of DRT services as typically implemented in the UK which address factors leading to exclusion are:

1. the offer of door-to-door journeys (sometimes subject to special arrangement);
2. the use of low capacity vehicles enabling individual assistance by the driver and meaning that the vehicle is shared with a small number of fellow travellers;
3. the use of vehicles with high accessibility configurations (low floor and/or access lifts); and

4. the flexibility of departure time (usually subject to constraints on pre-booking and availability; sometimes as a result of sections of route which do operate to timetable).

All of these characteristics assist in addressing physical exclusion, such as that result results from mobility impairment. The first two also address 'living space exclusion', for example where people restrict their mobility due to personal security concerns. The fourth point addresses the more subtle form of 'personal political exclusion' in empowering people to travel when they want and need, rather than having their movement patterns determined by external agencies, such as an infrequent or otherwise inconvenient public transport timetable. In addition, schemes in the UK are routinely subsidised to make them accessible to those suffering economic exclusion through limited ability to pay.

The importance of applying high technology to the supply solutions for the mobility deficit has been seen as essential in achieving the level of service that could genuinely reduce mobility-related exclusion (Brand, Rajé and Preston, 2003), whilst Enoch *et al.* (2004) emphasise the importance of 'smart' management such as vehicle brokerage arrangements in providing a range of vehicle types efficiently.

VPATS, then, would appear to make a strong case for being a sustainable way of addressing the mobility gap by virtue of the fact:

- it proposes new technology to manage the allocation of (mainly) existing assets better,
- it would create a virtual (if not actual) vehicle pool, with brokerage being achieved instantaneously through allocating most appropriate available vehicle type along with consideration of other factors such as current vehicle proximity, and
- because it goes beyond the DRT concept of being flexible in time and/or space, to include flexibility in its mode of operation (e.g. shared versus exclusive use; hail/set-down on street versus door-to-door; potential to 'upgrade' to a higher quality vehicle for specific journey purposes).

However, the concept of travel poverty also needs to be located within the contemporary cross-sector policy paradigm of *sustainable development*, and in particular within its 'local branch'; *sustainable mobility*. Here it must be noted that a number of authors have noted that social justice considerations risk being overlooked due to the focus of transport policy on the tension between demands for economic growth and environmental protection. Green and Wegener (1997) and Feitelson (2002) all support a vision of sustainable development which genuinely treats the needs of the *current* generations – seen in their true global diversity – on a par with those of future generations. Unless social equity, economic development and environmental protection are all seen as essential corners of a global equilateral triangle then environmental benefits achieved in one part of the world are likely to be consumed by the effects of competition for resources – and basic living standards - elsewhere.

Taking this international perspective, the industrialised countries will need to reduce their environmental impacts, and climate change emissions per capita in particular, in order to create 'growing room' for the industrialising world. The Kyoto Protocol

which entered force in January 2005, is one contribution to this global 'new deal' but seen as far too modest in ambition by some.

At the national level then, there is a tension between improving the conditions of the poorest members of society and achieving the reduction in the national environmental 'footprint' required to support change at the geopolitical level.

A further potential source of conflict lies in the potential for unintended effects which often emerge in the transport sector, due to the complexity of observed behaviour and the presence of unexpressed travel aspirations (Goodwin and Parkhurst, 1996; Feitelson, 2002). In the past, increases in the ease of travel or reductions in cost have been associated with greater pressures on land use, in particular from demand for more dispersed development patterns. Policies which instead seek to reduce average mobility levels may increase social exclusion amongst the poorest due to distributional effects.

Here, the role of VPATS may vary according to context. Three possible roles are apparent:

- VPATS might reduce travel poverty but also be associated with an overall increase in mobility;
- VPATS might provide for current levels of mobility more efficiently, whilst reducing the external costs of transport, including those leading to climate change;
- VPATS might increase mobility for users to some extent, but as part of a wider policy package which overall reduces the external costs of transport e.g. VPATS might be applied to reduce any regressive distributional consequences of the adoption of road pricing schemes, which would otherwise result in relatively poor car owners being priced out of travel in particular places and times.

The evidence from the Stage 2 report of the present study is that VPATS could have an overall sustainability benefit by reducing key environmental external costs, provided it can be operated at a very high productivity; a much higher productivity than current taxis achieve, as the latter are amongst the highest emitters of carbon dioxide per passenger-km (DETR, 2000: Table 2.7).

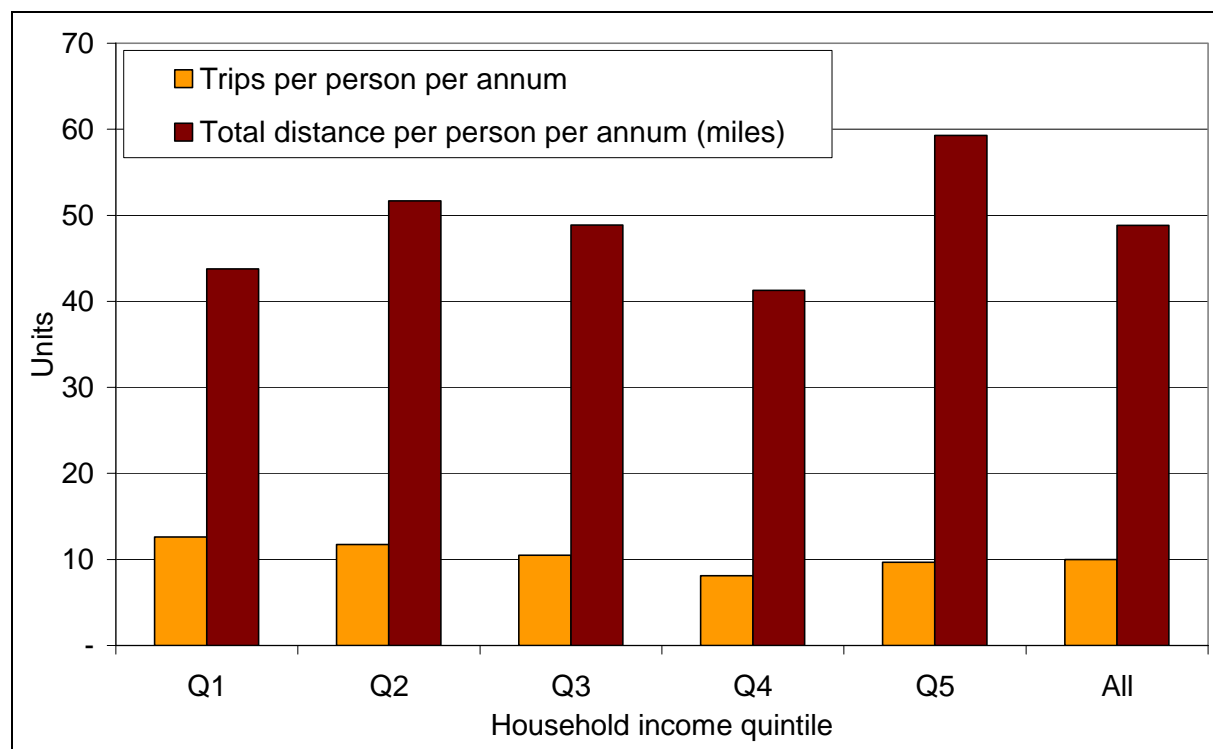
The cost of VPATS services is likely to be higher than bus fares, albeit for a high quality of service (door-to-door, higher comfort, usually higher frequency). Although this might suggest the services would be more exclusive than buses, it is notable that the highest levels of taxi trip-making are recorded amongst the poorest quintile of households (DfT, 2003 – 17 trips per person per annum) whilst people living in households without access to cars make more than three times as many as those without access to cars, with the most important journey purpose for the lowest income travellers being shopping (Noble & O'Hara, 2001). Furthermore, despite the cost of taxi fares having risen, the use of taxis has more than doubled amongst the lowest income group since 1985 (Social Exclusion Unit, 2003).

Figure 1 reports data from the 2004 National Travel Survey (DfT 2005) for all households (with and without cars). Taxi use remains low overall across all quintiles, with an average of less than one trip per person per month. Variance between income quintiles is also of a low magnitude, but trip rates fall further with rising

income, with 13 trips made per annum by Quintile 1 individuals compared with an average of 10 trips for the population overall.

The variation between quintile for total distance travelled shows a less consistent pattern, perhaps reflecting the availability of multiple cars in households in Quintiles 3 and 4, which enables individuals to avoid longer taxi journeys. Two explanations for why individuals in Quintile 5 make the most trips are that i) they are sufficiently wealthy that cost is a reduced constraint on taxi use behaviour, despite car availability being highest of all in this quintile and ii) they tend to be in occupations for which the use of taxis on employers' business is most common.

Figure 1: Number of Taxi Trips and Total Distance Travelled by Taxi by Household Income

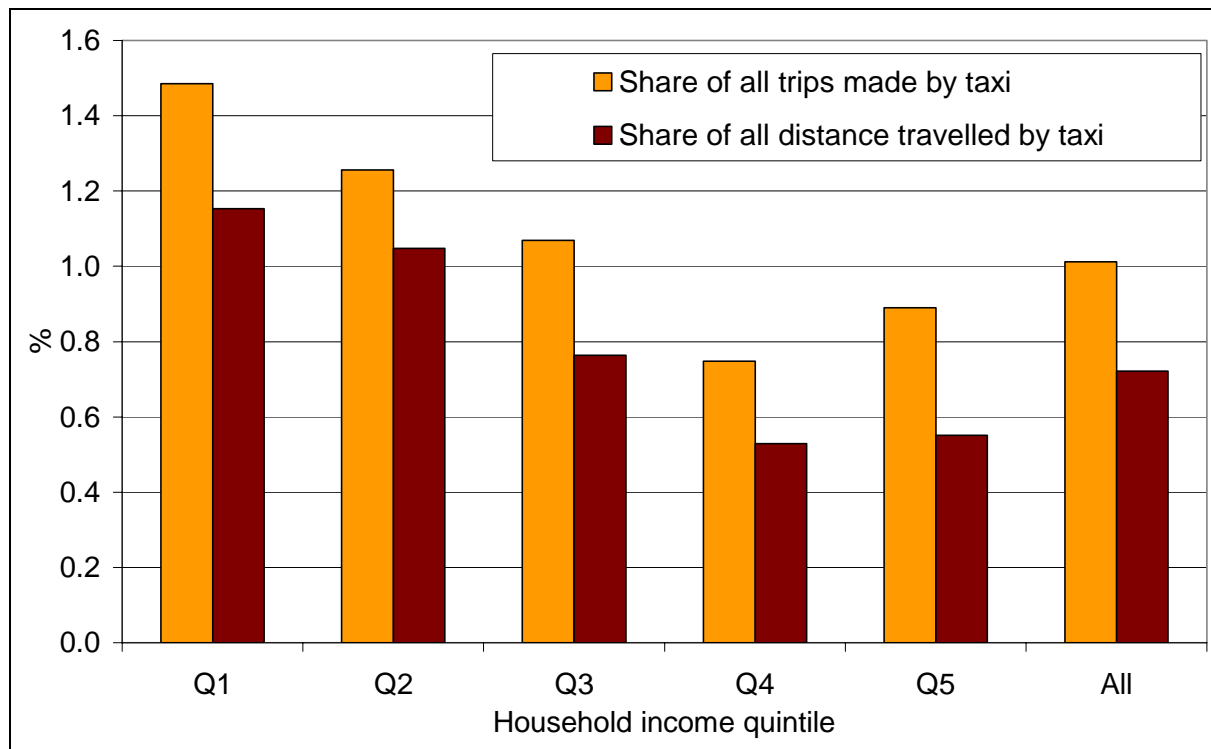


Source: DfT (2005) Table 5.5

The small variation in trip rates and distances travelled considered above needs to be seen in the broader context that trip rates and distances travelled by all modes show a strong positive relationship with income; individuals in Quintile 5 above travel around 2.5 times as far as those in Quintile 1 each year. For this reason, taxi travel is somewhat more important to Quintile 1 than suggested above. Furthermore, and importantly, due to the nature of employment status, this quintile is much less likely to be making taxi trips paid for by an employer.

Analysis of the share of trips and distance per quintile that is by taxi (Figure 2) confirms that, on average, very little travel by any income quintile is by taxi compared with other modes, but the rates of use are on average around double for the lowest income quintile compared with the fourth and fifth quintiles.

Figure 2: Average Share of Travel per Person Made Using Taxis by Household Income Quintile



Analysis of Data from: DfT (2005) Table 5.5

One further explanation for why taxi use is relatively high amongst low income households and households without cars is offered by the concept of ‘temporal exclusion’ (*i.e.*, mismatch between the journey times offered by other available modes and the time available to the individual to spend travelling). This is one form of exclusion which is not easily addressed by conventional bus services, which have fixed routes, possibly requiring long walks from origin and destination, often have low operating frequencies, and which may stop frequently. Furthermore, it is a form of exclusion that is also often not addressed significantly by low-tech DRT schemes implemented to date, as although the walk time is often eliminated, and wait for vehicle may be shorter, the vehicles make significant detours off the most direct routes between major activity locations to collect other passengers on a door-to-door basis, thereby adding to in-vehicle time. Hence, one key objective of VPATS is to achieve the advantages above without adding excessively to in-vehicle time, again, through the use of high-technology to maximise efficiency and productivity.

Lastly, considering travel poverty, it is notable that certain trends suggest the number of citizens at risk of exclusion on mobility grounds (or on other grounds but exacerbated by access to transport) is increasing. The UK population, along with those of most developed states, is ageing. There is a trend for those beginning retirement to migrate to rural areas, particularly in the south. Rural areas already have both significantly older populations than urban areas, and also demonstrate the greatest mobility-related exclusion. Hence, the future is likely to be one of a further increase in the age of the rural population, with more residents moving from mobile, car dependent lifestyles, to mobility-excluded car-less lifestyles, as health and the availability of driving licences and cars reduces with age.

This is not to argue though that urban areas are without similar problems. Indeed, the trend for both public and private sector operations to be consolidated on fewer sites per organisation, and this combined with decentralisation away from urban centres suggest, in the absence of significant policy attention, a risk that those living without car access in urban areas as well as rural areas will tend to experience greater mobility exclusion in terms of being available for work or study and obtaining goods and services. This is a trend likely to affect many urban areas as well as rural ones, as it is generally only the traditional centres of the larger towns that are well served by conventional public transport.

Returning finally to the issue of environmental sustainability, the current policy initiatives to tackle such social and economic exclusion through the new 'accessibility planning' approach – itself adopting increasingly complex technologies – seeks to identify 'holes' in terms of the accessibility of citizens to essential services, with the expectation that various measures will then be applied to 'fill them in', but with the assumption that increasing the range of public transport services offered will make a significant - perhaps the most important - contribution. There is a severe risk that seeking to do this with conventional bus services, or low-tech DRT options, will tend to offer a product that is only just acceptable for the needs of many citizens; not suitable at all for other citizens; and has the net effect of increasing the energy and cost intensity of public transport, without achieving any reduction in the use of more intensive modes, particularly the car. Hence, modest socioeconomic gains might be achieved for high environmental costs, both in terms of extra social cost (e.g. greater *per capita* carbon-based fuel consumption, extra external costs) and also opportunity costs for society in not adopting best available technology in environmental terms. If VPATS might represent the 'best available technology at reasonable market price' it is important to understand what barriers there might be to its introduction. The rest of this report examines these barriers.

3. Introducing VPATS Technology: Theoretical Market Considerations

“The potential for conflict between different service providers (e.g. bus and taxi) and between DRT and other public transport modes is very real.” (Brake et al., 2004)

There are a number of issues raised by the introduction of VPATS, not least in terms of the willingness of existing operators to adopt the technology or adopt antagonistic, competitive positions. One of the key features of the oligopolistic market to which VPATS is to be applied is its interdependence. In this highly competitive market – bus and taxi operators attempt to second-guess their rivals’ reactions to their own moves and this can be analysed by a much simplified model of Game Theory. Operators, in such markets can undertake various strategies which may range from price cutting to promotional campaigns and this can be illustrated in Table 1, the payoff matrix. This simplified model is based on two operators (a duopolistic market), one of which adopts VPATS and one which does not (perhaps a conventional bus operator). In the simplified model, each has two strategies open to it, namely either price cutting or promotion, although in reality they will no doubt have other strategies as well, including non-price competition⁴. The matrix is detailed in terms of increased market share, so that the left side of each box refers to VPATS increased market share and the right side to the non-VPATS increased market share. Clearly since VPATS is a new system then the figures given in Table 1 can be no more than illustrative⁵.

Table 1 Payoff matrix (increased market share %)

		VPATS-rejecting			
		Strategy 1		Strategy 2	
VPATS-accepting	Strategy 1	3	3	6	0
	Strategy 2	0	6	4	4

Given the payoff matrix, the operators (or players) can calculate their best strategy. This will be based on the assumption that each operator is aware of the outcome of the various strategies given in the table. If this is so then the VPATS-accepting operator will opt for Strategy 1, since at best this could result in an increased market share of 6% (if the non-accepter adopts Strategy 2) and at worst it could result in increased market share of 3% (if the same operator adopts Strategy 1). On the other hand, if the VPATS-accepting operator had opted for Strategy 2, the best it could

⁴ Although taxi-taxi competition in particular, and bus-bus competition to some extent are in practice restricted by licensing regulations and conditions.

⁵ In fact one of the criticisms levelled at Game Theory is that it is based on historical data, something which is clearly not available prior to VPATS starting operation.

receive is a 4% increase in market share and the worst would be no increase. The VPATS-acceptor therefore has a dominant strategy, namely Strategy 1, since whatever strategy the non-accepting operator adopts, the VPATS-accepter will always choose Strategy 1. If the payoff matrix is considered from the point of view of the non-accepter then the same outcome will be achieved, with that operator also opting for Strategy 1 (its dominant strategy). In such a situation equilibrium will thus be ultimately achieved, represented by the top left box in Table 1, with each operator obtaining a 3% increase in market share.

The above analysis is clearly hypothetical and it is not known with certainty what the impact of the option to adopt VPATS by market players (assuming it is an option), until that opportunity arises. Clearly, the exclusion of non-price competition from the simple model above is an important one, particularly given that the efficiencies of VPATS are expected to provide surplus, which could be shared between the producer in the form of producer surplus (or profit) and the consumer, through fare reductions (which would in turn provide a competitive advantage). Additional areas of uncertainty surround imperfect consumer information and brand loyalty (with the latter tending to be weak in the surface public transport sector but high for car use and private vehicle purchasing decisions).

However, the problem of inserting a new technology into a competitive transport context is not just one of theoretical economics, but involves politics, business skill, and psychology. It is not unknown for conflicts as referred to by Brake *et al.* above to have indeed occurred in quite literal, physical terms, for example the bus-bus 'in the market' competition which followed bus deregulation from 1986 (Wolmar, 1998). Even if VPATS does not result in new market entrants on a route or network basis (and it might well so do), 'fare wars' have been triggered in the past by promotional and fare campaigns alone.

4. Introducing VPATS Technology: Practical Barriers

To move from practice currently to any of the points represented by even the most basic VPATS scenarios there are a number of barriers to overcome. As part of the process of service design, it is to be expected that a series of issues to consider and barriers to negotiate will be identified for resolution before it can be successfully implemented. ARTS Consortium (2002: 14) defines barriers in the context of flexible transport services as things “which cause hindrance, delays or obstacles in the process of designing, planning and implementing new and more flexible transport services”.

The present section reviews four types of barrier that will need to be removed or overcome in successfully introducing VPATS:

- operator resistance,
- integration with existing travel systems and infrastructure,
- institutional arrangements, and
- monitoring and management.

These are considered in turn.

4.1. *Commercial resistance and reluctance*

Specifically, based on earlier research findings, operators have three main areas of concern in practice about wide-scale implementation of technologically complex, flexible transport services (Enoch *et al.*, 2004), which relate to economic issues such as market entry costs as well as understandable psychological stances, such as preference for the ‘stable and known’ over the uncertain (even if the latter is potentially more rewarding).

A high-tech, flexible transport system may involve an operator dealing with a range of complex bureaucracies. This is because the modes that might become flexible attribute ‘bundles’ within the VPATS portfolio - PHV, HC, flexible bus, conventional bus, community transport, education transport, social service transport, non-emergency patient transport services - are governed by a range of institutions and regulations which have significant implications for driver licensing, operator licensing, route licensing, eligibility for tax rebates, VAT liability, eligibility for public subsidy and insurance. For instance, to take the current equivalent of one VPATS operating modality, a taxi firm looking to set up a shared taxi service under Section 12 of the 1985 Transport Act would be eligible for Bus Service Operators’ Grant, but would need to register with the regional Traffic Commissioner (in addition to the local taxi licensing authority). Moreover, if the vehicle had fewer than nine seats it would be liable for VAT.

In the case that the core VPATS technology is not provided entirely by the state, but in some kind of partnership with the private sector or even by the private sector alone, similar reluctance and resistance may occur in the market to provide VPATS services, as well as the market to use them. The decisions taken about licensing and regulation would affect risk and profitability, and would tend to attract companies with experience of regulatory structures similar to the particular one chosen and

discourage those without. Some initial considerations relating to this commercial context are drawn out in Section 5.

Second, VPATS will involve installing new technology – certainly off-vehicle and possibly in-vehicle - generating a cost barrier, which is likely to require either capital funding or external financing. Although the introduction of VPATS will emphasise reuse of existing transport sector assets where possible, it is likely that it may involve new capital assets other than for the technology, and other than would be expected in the normal fleet replacement cycles for conventional operations. For example, there may be a particular scarcity of taxis in some rural areas (White, 2003; Richardson-Dawes, 2003), so additional vehicles may be required to meet high standards of VPATS provision.

Third, even if such barriers are tackled, there is still significant uncertainty and limited information as to the level of additional demand for a VPATS-assisted transport system over current levels of public transport use, and hence, the financial viability of investment in the technology. One of the nearest current equivalents would be the higher-technology variants of DRT bus services. Here, Brake *et al.* (2004) question the viability and sustainability of DRT services in general over longer time periods. Similar questions are asked by Mageean *et al.* (2003) who point out that: “[t]he potential for reducing transport costs and improving or sustaining citizen mobility through the introduction of DRT services is not yet fully established.” Notably, however, DRT has mainly been targeted at ‘marginal’ niches, which have been identified as hard to serve by public transport, and rarely at mainstream public transport markets, including in urban areas. And even Mageean *et al.* do consider that the wider integration of DRT services into existing transport networks will be required to approach financial sustainability, which is one outcome that would be achieved with the VPATS approach. Nonetheless, confidence in the market potential remains a significant barrier, and perhaps in part reflects the woefully underdeveloped marketing capability of the vast majority of UK public transport operations, both in identifying potential users and in selling their services effectively (Hibbs *et al.*, 2005).

The above summary of barriers describes a pattern of operator *risk aversion*, observed in the past as arising from the introduction of a number of innovative transport systems. However, in VPATS terms, past innovative systems can be seen as representing a single (or perhaps on occasion a couple of) service attribute bundles. In the scenarios it is assumed that VPATS gradually replaces PHVs and HCs, whilst operating some bus-type services. In adding a layer of complexity, some of these bundle combination issues may be compounded. Furthermore, VPATS is radical in introducing ‘flexible-in-mode-of-operation’, as distinct from transport systems which are flexible only in time and/or space. Hence, it can be argued that there is likely to be an even higher risk premium, whether in terms of money or mental orientation, associated with VPATS as a novel idea, unless individual operators’ fears can be effectively minimised.

As noted in Section 3, such perceptual barriers are likely to exist in association with economic market entry barriers. They are perhaps most likely to be overcome by successful entrepreneurship leading to market transformation. Notably, four additional operators were happy to cooperate with the Lincolnshire InterConnect

flexible bus scheme once the initial operators had pioneered the concept and proved that it could work (Cross, 2003).

4.2. Integration of VPATS with existing modes, infrastructure, systems

Service specification requires the definition of which demands a service will seek to serve, and how the new service relates to existing supply, which to a greater or lesser extent will already provide for the identified demands. Hence, there is concern for how VPATS will interface – or integrate – with existing services. Potter (2005) suggests that there are six modes of integration in the transport context, which can be categorised into four operational and two strategic forms:-

- Operational forms.
 - 1) Physical Integration: Being able to easily change between transport modes (using interchanges) - services connect in space.
 - 2) Timetabling Integration: services at an interchange connect in time.
 - 3) Ticketing Integration: not needing to purchase a new ticket for each leg of a journey.
 - 4) Information Integration: availability of information for all legs of a trip available at a single source, or closely integrated sources.
- Strategic forms.
 - 5) Service Planning Integration: legal, administrative and governance structures (institutions) encourage (or at least permit) integration.
 - 6) Travel Generation Integration: integrating the planning of transport with the planning of generators of travel.

As VPATS is fundamentally flexible, it would avoid a number of implementation problems related to integration arising from the fundamental inflexibility of existing transport operations.

Public transport passengers are regarded as generally disliking the requirement to interchange, although this may be because currently the system is not designed to facilitate it properly. In any case, *physical integration* under a mature VPATS implementation would arguably be of reduced importance, because there would be less need to interchange between VPATS vehicles compared with bus routes⁶. Furthermore, VPATS may run in competition with non-VPATS operators, so integration may not be encouraged by the market. Furthermore, bus stop provision (integration between walk and bus) would be less necessary, as many services would be door to door. The main interchange venues are likely to be a) city centres, where VPATS is likely to offer hail and ride (electronic or traditional) plus rank access facilities, and b) interfaces with non-road transport which are sources of patronage for VPATS e.g. railway stations, airports, seaports, where infrastructure needs will be similar to current car or taxi set-down and pick-up arrangements. Additionally, there may be a requirement for integration with private cars at park-and-ride services, and, assuming VPATS operates on a local or sub-regional basis only, with express coach services providing road transport to destinations further afield.

⁶ Although VPATS vehicles might have range limits imposed by the system or the driver, requiring interchange to another VPATS vehicle or conventional transport system.

One caveat here, however, is that interchange may be more relevant at a juvenile stage in development, when VPATS serves only part of a local area, or perhaps operates as a subsidised feeder to conventional public transport routes.

Even more reduced than physical integration is the need for *timetable integration*. Provided VPATS achieves sufficient scale and productivity, it will operate on a 'nearly available' basis, with lower wait-times than for PHVs. Hence, VPATS should automatically integrate with other inflexible public transport modes, although service planning may be necessary to ensure sufficient vehicles are in the circulating pool to manage periods of peak demand that may be associated with the arrival and departure of high capacity public transport services, such as long-distance express trains.

To maximise the productivity of VPATS it would be appropriate to apply a high-technology form of ticketing that minimises or avoids cash handling, such as the Oyster system adopted for London, which allows electronic swipe payment. Introduction of a novel ticketing system along with a new scheduling system might be relatively easy, in comparison with persuading users of an existing system to convert. *Ticketing integration* with non-VPATS operators would be facilitated if they too took part in the integrated electronic ticket.

Information integration may be less essential as the whereabouts of specific bus-stops may not need to be known; VPATS could use some conventional stops, or a larger number of very diffuse hailing points (with remote electronic request and notification), or even directly serve a complete range of possible origin and destination pairs. Similarly, as noted above in the consideration of physical integration, there will be a reduced requirement for integration of information provision between VPATS-scheduled vehicles if interchange is reduced compared with current public transport options. However, where interchange information remains important, it will be essential to ensure high quality provision, in order to maintain overall system integrity with the public.

A decision would need to be taken as to whether promotional and marketing information would focus on the new VPATS technology as an integrating influence, or whether a more successful marketing strategy might treat VPATS as a 'black box' out of the public gaze, avoiding drawing a publicity boundary too tightly around the system itself, with the marketing emphasis instead on the individual modal attribute bundles and what the services mean for the customer (traveller). A compromise dual-identity approach might also be considered, as in the case of computer and computer processor brands, where brands of individual processor components such as the Intel Pentium are marketed independently as well as alongside the computers that contain them, such as Dell or Hewlett Packard.

Although integration between modes may be less essential to a mature flexible system, as is observed with current DRT services in marginal niches, *service planning integration* may be an important contribution to viability when establishing a VPATS. Where institutional barriers exist (*i.e.* legal, administrative and governance structures) then reform would be desirable.

Similarly, *travel generation integration*, particularly integration with land use planning, could be important for the development of VPATS, particularly in a context in which accessibility planning grows in importance. External events such as the adoption of organisation-based travel plans by particular employers, the reorganisation of hospitals, local government or other major generators, or inclusion of social service or voluntary transport services within VPATS could be important stages in market transition.

In general terms, although integration between modes is arguably likely to be increased intrinsically by the VPATS technology, it will be important to ensure that if multiple operators provide the VPATS, as occurs with current taxi fleets, then certain factors including information and fares will need to be consistent across the network if the customer is to experience it as a unified, continuous offer. This may require some participating operators to compromise in accepting potentially sub-optimal conditions from an individual perspective. For example providing a high quality service also at periods of low demand might be important for providing an attractive service overall, but this might require a degree of revenue sharing and possibly shift coordination arrangements between drivers, to avoid 'free-riders' making themselves available only at lucrative periods of the day.

4.3. Institutions and partnerships

Perhaps the closest model of how a commercially-operated VPATS scheme in the UK might look in practice can be found on the Indian Ocean island of Mauritius (Enoch, 2003). Here, there are number of complementary (and commercially motivated) public transport services. These include:

- full-size buses operating traditional timetabled services,
- full sized buses effectively providing turn-up-and-go services in peak periods from large trip generators,
- 'light' midi/mini buses providing timetabled or arranged services to employers, hotels and schools for example,
- taxis providing so-called 'taxi-train' supplementary bus services (whereby taxis effectively operate as four-to-six seat non-scheduled buses), and
- taxis operating as conventional taxis.

However, in terms of barriers to development, as might be expected in a developing country context, institutional barriers are slightly less complex for all the possible public transport options, as buses, light buses and taxis are all registered by a single body, the National Transport Authority. Market barriers too are reduced, as not only taxis but light buses and even a significant proportion of full-sized buses are operated by owner-drivers or at least very small operators. Further, technology costs have not been an issue as these services are operated in a low-tech fashion. Perhaps the most important factor, though, is that for many years the demand for transport as a whole has been rising fairly rapidly, and although buses are now struggling slightly to maintain patronage in the face of growing car ownership and use, the whole commercial system evolved when there was enough (almost too much) work for all to benefit. This has not been the case for many years in the UK.

At the local level, Nelson and Wright (2003) regard institutional barriers as being the main problem facing flexible transport schemes. Organisational issues and

operating/cultural barriers should not be dismissed as trivial, because they can be critical for the success of a service: public transport systems tend to work best when the bodies involved (operators and local authorities) work together in a partnership. In addition, in the case of VPATS, it is likely that there would be a separate, additional actor involved, responsible for providing the VPATS, which interfaces with the public (via telephone and internet) and with the operators (probably by a bespoke GPS-based communications system).

Evidence about the importance of partnerships is available from studies of lower-technology flexible systems. Armstrong (2003) notes that flexible services require more partnership support than conventional bus quality partnerships, whilst Howcroft (2003) observes that operators and local authorities actually stand to gain from a partnership financially, because bus operators tend to be revenue rich and capital poor, while the situation is reversed for councils.

Where VPATS promotes or requires the introduction of new vehicles, local authorities can play a key partnership role by purchasing them and then leasing them to the operator(s), requiring capital spend but then creating a revenue stream. Such practices may be particularly important for small scale investments made for social service reasons, as larger bus operators are able to spread capital investment costs for vehicles in a range of ways, including by paying in instalments and by replacing portions of fleets in rotation.

The 'vehicle brokerage' pool approach has been applied in the Region of Arnhem and Nijmegen in the Netherlands and is currently being developed by an increasing number of local transport authorities in the UK (e.g., Somerset County Council and Cheshire County Council). The rationale is for the local authority to use its existing financial support levers to integrate incrementally as many transport providers as possible within a single coordinated system. Under this approach, the closest-to-appropriate vehicle available for a particular social service⁷, education, tendered bus or community transport service can be allocated as and when required, potentially reducing capital costs by reducing the overall size of the necessary fleet and achieving operating costs advantages by matching supply and demand in a better way. Such a brokerage facility could run in parallel with a commercially owned fleet, with the two interacting as appropriate⁸.

It is also clear that good relations will need to be established with the full range of local transport operators that might be persuaded to join VPATS or, if alienated, might instead seek to compete. A serious operational problem that has afflicted innovative public transport projects in the UK and elsewhere is the emergence of *active opposition* from rival transport operators. In Truro, for example, taxi operators have often felt threatened by DRT (the Plus Bus) and have reported DRT vehicles being kicked and spat on, resulting in the use of a depot for security reasons

⁷ Often currently covered by 'dial-a-ride' operations.

⁸ Galvin (2003) reports that Commuter Cab Plc (CC) is already involved in a low-tech 'brokerage' partnership arrangement with the Commission for Accessible Transport for North East London Dial-a-Ride (NEDAR) which covers a number of London Borough areas. This involves CC taking all booking requests, NEDAR scheduling what it can provide as shared vehicle journeys provided from own resources and then passing the remainder back to CC to provide as exclusive use taxi trips. This improves the loadings and service on NEDAR buses.

(Crossfield, 2003). And in Bicester a number of incidents, some physical, have occurred between taxibus and taxi drivers (Kelly, 2003). Outside the UK, Cervero *et al.* (1995) noted that opposition to DRT in the USA from both taxi and public transport operators has resulted in pressure on licensing authorities to reject applications for commercial licenses.

Political pressure against innovation may arise from the trade unions, as in Arnhem in The Netherlands, where hostility to the Regiotaxi KAN scheme grew from the transport unions as they perceived a risk of lower-paid taxi driving jobs replacing better-paid bus driving (Zuijderland, 2003).

However, it is the HC and PHV firms that are arguably of greatest importance to VPATS, as PHVs are especially relevant for serving less affluent markets (Duffell, 2003), and reallocating HC and PHV assets and skills will be a logical and cost-effective means of constructing VPATS. Overall, the research conducted for Stage 2 suggests that VPATS will offer an opportunity to the HC and PHV trade, with the potential for greater profit as a result of higher productivity.

Commentators have observed, though, that dealing with taxi operators is notoriously difficult, even where there is a vibrant market (Drummond *et al.*, 2003; Herraty, 2003). The operators tend to be used to 'running their own businesses on their terms'. Joining VPATS and being expected to work in partnership with the local authority and others would be a departure from their traditional mode of operating. This cultural aspect is probably important in the difficulties experienced in getting taxi firms to tender to operate existing flexible schemes. This has been overcome in a number of overseas projects by involving taxi associations from the beginning of the scheme's design, not just as a supplier when everything is decided.

In including 'institutions' in a wider sense, it will also be important to consider the needs and aspirations of local trip generators, *e.g.*, employers, retail outlets, *etc.*, that could encourage their staff and visitors to use VPATS-coordinated services, or even potentially sponsor or contribute towards the costs of providing the system.

Finally, clear communication channels with the various licensing, regulatory and financing authorities can smooth the path of implementation enormously. This is likely to involve seeking informal advice as well as formally applying for service registrations. This lesson was learned the hard way in Hampshire, where the first shared taxi scheme was implemented without the knowledge of the local Tax Officer, leading to some problems (Smale, 2003).

Strong *political support* is vital for any transport project (although the experience of the 1986 bus deregulation is that this alone is insufficient for innovative schemes to emerge). Whereas buses may not be seen as being 'sexy' by politicians, there is often political enthusiasm for innovative transport schemes despite the costs. Local politicians are often keen to be associated with more innovative service delivery in general, and this will be strengthened if policy objectives are also appealing, such as replacing withdrawn tendered bus services. Indeed, "members are almost too keen on DRT – they all want it in their area" (Usher, 2003). One reason why politicians seem to be positive towards innovative solutions is the expectation that they will provide a cheaper alternative to a conventional bus service (Armstrong, 2003). This

may be true in the case of VPATS, as supported by the analysis in the Stage 2 report, provided that the comparison is for notionally similar levels of service as would be provided by conventional buses. However, it will be vitally important to explain to politicians that VPATS should not be simplistically evaluated against whether it provides the 'cheapest alternative bus service' but that the system will provide new journey opportunities and 'life chances'.

However, there can be resistance to innovation amongst the public, at least initially. There was negativity towards the replacement of a conventional bus service in rural Hampshire by the 'Cango' flexible bus for about a month following the change, but subsequently the vast majority of travellers (and all the politicians) were extremely happy with it (Armstrong, 2003). One reason for concern may be a preference for the *status quo* due to fears that the new service may fail, so leaving a community without any transport (Buchan, 2003).

In recognising the evidence for local politicians being supportive, however, it is also necessary to observe that there is likely to be some resistance where a local authority has invested heavily in specific types of service which might be, or appear to be, threatened by VPATS technology. For example, there might be less need for edge of town park and ride (P&R) schemes served by conventional shuttle buses if VPATS can improve rural transport services, but the P&R might have been built-up over time, at expense, but with some municipal pride.

Another example might – with some irony - be the presence of revenue-generating municipally-owned car parks, which might lose patronage to the extent that VPATS encourages modal shift from car. More generally, there is the issue that any local authority investment in VPATS may be seen as having an opportunity cost, which may be perceived as being at the expense of other types of public service, or specific geographical areas, in particular any which do not immediately and directly benefit from the system.

Nonetheless, it will be of key importance for the promoters of VPATS to overcome what has been seen as a natural reticence or 'awkwardness' on the part of local authorities to partner with entities such as community transport organisations and taxi or bus companies (Nelson and Wright, 2003). It will be essential that VPATS is presented from the context of a novel partner institution, not associated with bad practice from the past, and that the local authority achieves a level of psychological (if not financial) ownership.

4.4. Effective management of VPATS in operation

Once VPATS is in place it will be essential to monitor its operation in order to

- demonstrate the benefits to participating operators,
- enable effective management, according to objectives such as optimising system output and rectifying identified problems,
- inform an ongoing process of marketing and market research, possibly leading to a re-design of some aspects of the scheme, and
- in order to comply with the relevant regulatory framework(s).

The basic input of this process is monitoring data. Under the latest registration requirements for flexible schemes (made in February 2004) – under which VPATS is likely to fall - monitoring forms a far more important element than previously, and operators are now required to keep a record of passengers' names, addresses and phone numbers (plus trip details) so as to be able to prove that a trip was carried out. From the perspective of the operator's own interest, data streams which determine how effective VPATS is in delivering passenger journeys might include reliability of scheduling software, cost and revenue per passenger trip (and passenger kilometre), average vehicle occupancy, call centre refusal rates, and number of no-shows (both of vehicles and passengers). The primary means of collating this data in a high-tech environment would be the system control software, but additional data might also be sought from user and non-user surveys, call centre monitoring, and 'mystery travellers'.

Monitoring data can be combined with local geo-demographic information to conduct market research analyses. For instance, the SAMPLUS project for the European Commission developed a range of indicators for economic viability, service provision and technical performance (Duffell, 2003). Duffell goes on to say that clients of his technology provider *Mobisoft* typically use the data of trip patterns to modify their routes after six months or so. In the case of VPATS, data might be used to derive information about the variation of demand through time to inform asset resource allocation by time of day.

One bonus of flexible transport schemes is that the variable nature of the services actually makes it relatively easy to modify them in response to market information in comparison with conventional services. In the case of VPATS, although there may be some system zones and boundaries⁹, there would be no core route or timetable; only service specifications defined in terms of maximum wait times (perhaps varying by time of day). Hence, operators are likely to be able to vary parameters in a subtle way without provoking strong user responses (where that is not desired). This also means VPATS will be a very relevant option for exploring new markets for public transport in areas that may never have supported a conventional bus service.

⁹ As noted above, there may be VPATS zones within which particular attributes (vehicles, drivers, fare payments) are ring-fenced. Furthermore, there are likely to be boundaries to the VPATS service area, beyond which other modes would have to be used, at least in the early stages of implementation, as it is likely that the system would initially be provided in particular localities.

5. Synthesis: A Scenario for Implementation

As VPATS is not a new transport mode as such, but a radical, more efficient way of delivering a range of modes, it is likely that it would emerge in a different way to that which has often characterised new modes in the past. These have tended to be based on mode-specific technology, with the new mode introduced by private or public entrepreneurs identifying a niche in the market place and this subsequently leading to market dominance with the ‘sweeping away’ of any rival lower-technology modes¹⁰. In the case of VPATS, the benefits are unlikely to result from a radical change in a specific attribute compared with current modes, akin to the speed increases brought in the past by rail or air travel, but to be cumulative over a range of attributes (e.g. less waiting time, similar in-vehicle time, lower fares). Hence, a market evolution rather than revolution seems more plausible.

Given that VPATS involves a core technology which, to work efficiently over a wide enough geographical scale, is likely to involve a range of existing operators of existing modes, each of whom would enjoy only a part of the total available benefits, a more realistic model is perhaps some kind of partnership between the public and private sectors. Notably, this was the case in the establishment of commercial airlines in Europe, in which barriers to efficient operation (including financial ones) were initially too high for an entirely private-sector offer. It has also been the model for re-investment in and expansion of public transport services in large parts of the world in the last fifty years.

Stage 2 presented six scenarios for the introduction of VPATS. Although each could in principle arise in isolation, it is more likely the system would evolve and the scenarios taken together in fact offer one possible sequential outcome. The scenarios included estimations of real-world operating characteristics, including consideration of likely infrastructure costs, patronage levels, subsidy requirements and fare levels. These are now revisited in the context of the real-world constraints described above.

5.1. Initial steps

The most obvious initial market segment for VPATS is seen initially (Stage 2 Scenarios 1a, 1b & 2) as enabling superior taxi-style services, by reducing waiting time and price, but with the significant difference being the (largely) new attribute bundle in the form of non-exclusive use services being offered as well as exclusive reservation of a vehicle. Hence, in practice, early competition is likely to arise between those offering VPATS-assisted and low-tech taxi services, and it is assumed that the majority of patronage in this initial period of operation would be from travellers who would otherwise choose the existing taxi product. Given the strengths of the VPATS approach, however, it is assumed that a) the system is successful, and b), other, perhaps initially sceptical, taxi operators will seek to join the enterprise as a second wave of adopters. The public sector may seek to have social service transport commitments, such as ‘dial-a-ride’ brought under VPATS

¹⁰ Such as happened in respect of most major public transport ‘revolutions’ in the past, including canals, railways, motor buses and motor taxis.

management, with the public authorities providing operating and asset cost funding in exchange.

For the sake of analysis in Stage 2, it was assumed that the resources necessary to provide and operate VPATS-specific assets would be sourced from the current taxi market, by identifying an early-adopter taxi agency entrepreneur, who in turn is able to convince his/her associated individual HC and PHV owners and drivers to support the new technology, as it is in their economic interests.

An alternative, non-market approach might be for a local authority to mandate cooperation with the VPATS as a condition of licensing. This in principle would enable licence charges (and agreed fares) to reflect the investment costs in the new system and its subsequent benefits.

The key issues for introducing VPATS would then be:

- integrating VPATS operations with the existing regulatory frameworks for HC and PHVs (or seeking their suitable amendment),
- funding and financing the new VPATS-specific assets e.g. the GPS-based scheduling and dispatch system, and
- implementing an appropriate pricing system for the range of attribute bundles and user types.

Licensing VPATS vehicles

In London, PHVs and HCs are licensed by the Public Carriage Office of Transport for London, while outside the capital either the district council or unitary authority (whichever is in place) is responsible. In order for VPATS vehicles to provide for both pre-booked journeys (currently usually in response to a telephone request) and for journeys hailed on street or from a rank, a starting point would be that they would need to be registered as HCs, rather than PHVs. In some places, particularly if incumbent HC operators did not engage with VPATS, then HC license quota limitations may create a specific market entry barrier. HC license conditions are usually more stringent than PHV conditions. Where licenses are available, then transferring licensees may need to comply with conditions such as providing a wheelchair accessible vehicle. This might reduce some of the flexibility in operation of theoretical VPATS attribute bundles.

The geographical and population sizes of HC licensing districts outside of London vary considerably (e.g. from around 150 thousand to one million inhabitants), and might not be the appropriate spatial unit over which to organise a VPATS 'operating cell', so cross-hierarchy and cross-border working might be necessary, perhaps coordinated by the appropriate county council or metropolitan passenger transport authority, or through the association of neighbouring unitary authorities (as in the former Avon area). A further alternative would be to organise VPATS at the regional scale, as occurs with taxibus services in The Netherlands. This would be likely to require primary legislation.

Given the intention expressed in the Stage 2 report that at least some bus services be brought into the VPATS, and given that these are already coordinated at the county level, or by PTEs, or by Transport for London, then transfer of taxi licensing

powers to a higher level would arguably facilitate the introduction and efficient operation of VPATS. However, districts have tended to regard their taxi licensing conditions as an important local power, and have so far resisted such a move.

The case of London raises a similar issue, where having one VPATS cell per borough might offer too many, insufficiently integrated systems, but having a GLA-wide system may exceed the efficient operating scale. A sector-based approach, with appropriate arrangements for interactions between the sectors, might be considered. One option for future evaluation might use quadrants described by the River Thames and an imaginary north-south line along the alignment of Tottenham Court Road. Journeys between these quadrants would need to be perceived as seamless as possible by travellers. From the operators' perspective they might though require an additional hierarchical step in the scheduling system's processing and they might need to be subject to a different level of service. Given the intensity of demand in Central London itself, a fifth zone might also need to be identified within, say, the congestion charging zone boundary.

Funding VPATS-specific assets

It is beyond the scope of the present study to estimate the costs of providing the core VPATS technology, but some broad considerations are raised here in terms of how VPATS might evolve given likely regulatory and funding constraints.

In principle, there would be nothing to stop a specific operator introducing a VPATS as a natural extension of existing operating and managing practice, such as the use of a telephone call centre for taxi or flexible bus service, and using routing software to optimise a schedule. In practice, however, few radical systems have been trialled by the private sector in the twenty years since bus deregulation, apparently due to a combination of limited investment capital in the public transport sector and risk aversion. This situation suggests an entirely private-sector initiative is unlikely.

It is most likely, then, that at least part of the initiative and funding and or/ financing will arise from the public sector. It is observed that the *Transport Direct* national traveller information system has been funded by the DfT at a cost of around £50 million to date. In contrast, VPATS would consolidate and schedule the demands of actual travellers with respect to operating assets, often in a real-time situation, and would need to be more 'fail safe' than an advisory information-provision system. It would appear at face value to present a different order of magnitude in terms of IT project than Transport Direct, and hence unlikely, particularly given the general favour shown towards financing in partnership with the private sector, to be directly funded by government alone.

The London Congestion Charge (LCC) may offer an example at the other extreme, with broad-terms capital investment costs of £250 million and annual operating costs of £100 million, due to the intensive administration involved in data handling, detection of offences, and enforcement. That system also produces a strong revenue stream, however, of around £130 million per annum. The Stage 2 report for the present study indicated that the cost savings associated with VPATS might be worth up to £2 million per annum from a comprehensive system in the much smaller urban area of Bristol (perhaps equivalent to £32 million pro rata in the case of London).

There may also be a case for increasing revenue from VPATS by offering additional high-tech services to operators, such as real time monitoring of driver and vehicle behaviour, as in the case of the complex (and initially troubled) high-tech GPS-based road user charging scheme for lorries using Germany's roads.

One model, then, might be for national government to provide a policy framework, perhaps including new legislation to be brought forward, and either national or a lower tier of government might commission technology from the private sector, in the form of a contract involving the detailed design, production and operation of the core technology, in return for a share of risk and profit. VPATS would emerge, as is the aspiration in the case of congestion charging, initially in a number of mainly urban-based cells around the country, with compatibility ensured between systems so that vehicles, and driver and user experience, are interchangeable between them, and so they can ultimately be directly interfaced with each other, as individual cells become a 'honeycomb'.

Variations on this theme, supposing a more attractive ratio of capital and operating costs to revenue, might involve national government (or possibly another tier) acting as an issuing authority for national, regional or local VPATS licences. In principle there might be multiple licences in one area, with similar or different technologies providing competing services to transport operators. In practice, the strong desire for integration in the transport sector and the possibility of economies of scale suggest local monopolies might be permitted (as in the case of the water companies), with appropriate tough regulation then required. In the case of regional monopolies¹¹ being created, the five large UK bus groups – themselves already often in practice local monopolies - would have clear interests in respect of who was owner and operator of VPATS. Thought would need to be given to whether 'vertical integration' as a result of one of the big five actually being the VPATS operator would be desirable, or in fact permitted. In the case of vertical integration, the VPATS owner-operator would be allowed to become one of the key, but not necessarily sole, customers of the system, raising issues of fairness to other system users.

Another possible variant in this evolutionary narrative might emphasise the local character of VPATS. Most of the transport services to be delivered by VPATS-using operators will be within a particular district. Local politicians – many seeking greater regulation of the taxi and bus markets - may seek to retain at least as much local public control over service quality as they have now. The number of transactions the VPATS technology would be required to make, even in a specific town, is likely to be great, suggesting a decentralisation of processing capacity. Drivers of the current modes likely to join VPATS are used to making short-to-medium range journeys on a scheduled or on-demand basis, but generally do not expect to make unscheduled, cross-country journeys. All of these factors suggest a distributed control system based on relatively local cells is likely.

In this case, there may be scope for local highway authorities (county and unitary councils) which prepare Local Transport Plans to bid for support from funding streams administered by the DfT. The 'Major Scheme Bid' (MSB) procedure allows the authorities to prepare and justify cases for national investment in major local

¹¹ Except inasmuch that there is potential for competition in the market.

projects costing more than £5 million, which will have a particular benefit in terms of achieving the broad objectives as set by national government and the local authority. Many of these MSBs have recently been considered for the first time against regional priorities through the new 'regional funding allocation' procedure. For example, the four authorities in the former Avon area recently had MSB accepted under the RFA which will lead to the systematic upgrade of 35-40 major bus routes in ten corridors across the Greater Bristol area over a number of years, at a cost of £70 million (60% of this from DfT funds).

Another possible funding stream might be the DfT's Transport Innovation Fund, although this would require linkage of VPATS to a broader transport policy seeking explicitly to address either i) congestion or ii) 'productivity'. Schemes which are funded to reduce congestion will almost certainly involve road user charging (although VPATS could clearly be presented as a reciprocal policy measure, as a means of increasing the availability of alternatives to the car, and possibly an investment target for hypothecated revenues). The 'productivity' objective, instead, is likely to provide funding for investment in increasing transport capacity, which is likely to mean better traffic management of existing highways, some new roads, and increased public transport capacity.

In all these cases, VPATS would be pitched into competition for funds with road, light rail, guided bus and other high profile schemes, many of which have been in engineers' or politicians' filing cabinets for many years already. Success in obtaining public capital investment to support the technology would only come with successfully selling the political idea of VPATS at the national and local levels and linking it closely to existing transport policies and programmes, where possible.

Pricing system

The VPATS pricing system will need to be able to reconcile some or all of:

- the different real-terms costs of providing different attribute bundles,
- the need to apply subsidies available for specific journey types only (i.e. Bus Service Operators' Grant and VAT exemption) for those classed as 'bus'¹² journeys under the current system,
- the ability to accept users with fare reductions and exemptions, including the young, mobility impaired and old (most of whom will travel for free in their home districts now, and free nationally from 2008), and to
- provide some level of cross-subsidy in order to optimise demand with supply throughout the day and across the network as a whole in space.

The system can be simplified in the first instance if VPATS provides only for taxi, shared taxi and local authority social/school/community transport journeys, as these will tend to avoid the issues of bus-related subsidy and concessionary fares.

The Stage 2 analysis assumed that the key supply-demand regulation instrument would be the difference between fares for exclusive and shared use. The efficiency of the technology was assumed to be sufficient that exclusive use fares still offered a better generalised cost option than current taxis, whilst generating significant

¹² Eligible journeys require the vehicle to be licensed as a bus and operating a registered service.

revenue to support shared-use journeys. The integrity of this system is dependent, however, on it not being possible for a rival VPATS supplier to exploit the technology by providing for the coordination of selected profitable, exclusive use, journeys only, so avoiding the burden of cross-subsidy between user types. Similar arrangements saw the demise of some bus routes following deregulation. Avoiding such a market entrant emerging might require a local monopoly license for application of the technology.

A further simplification of the Stage 2 analysis was that no peaking in demand was allowed for. VPATS may reduce the importance (as opposed to the incidence) of peaking for transport operations by using a larger number of smaller vehicles, with more owner-drivers working shift patterns, so it may be possible to match supply to demand more effectively. There is still likely to be greater pressure on the system at peak times, however.

Demand restraint pricing can be effective in smoothing out peaking, as practiced extensively by the airlines and railways. However, it is usually partly socially exclusive in achieving its outcomes, as not all travellers have a similar ability to pay to satisfy a given level of need. It would also be unpopular in a local transport context in which people often make a particular journey frequently, often at short notice, and who are perhaps unprepared to examine a large quantity of information prior to making a routine trip: there is an expectation of a broad level of stability in prices for a given service, and a very efficient pricing mechanism from a supply-demand perspective would be unpopular. Other rationales for varying charges might be to apply combinations of the following measures:-

- Pass on a higher charge applied by a road pricing system for a particular vehicle trip to the occupants of the vehicle, so high occupancy vehicle users pay less per traveller.
- Charge a modest supplement on a more fixed basis for peak travel of, say, 25% on all fares.
- Increase system efficiency in the peak by giving an incentive to encourage travellers to self-group their demands by giving a discount for a certain party size, and perhaps a further discount if the group assembles at a convenient collection point (such as a bus stop) on a principal road. (In practice, such groups might be exempt from the peak supplement suggested in the previous point).¹³
- Increase the peak loading on higher-value attribute bundles, in recognition that they are more resource intensive to deliver (but only where a less resource-intensive alternative exists). Loading these fares rather than all fares is less likely to be socially exclusive. (Although this approach might contradict the lessons from Section 2 on taxi use, the current system offers only bus and taxi, whilst intermediate taxibus and shared taxi options will be provided by a VPATS-coordinated market. It is not likely that these 'intermodes' would be offered at a premium.)

¹³ Encouraging a certain amount of walking by mobile citizens would in fact attune with the public health agenda of encouraging exercise. A downside of a very efficient VPATS providing entirely door-to-door service might be a less healthy population with more lazy habits. There might be an important external-costs-to-the-health-service economic justification for charging a premium for door-to-door delivery in general.

- Give a discount or extra discount for pre-booking in the peak, or an exemption from a peak supplement, in reflection that it should be possible to schedule pre-booked journeys more efficiently, with less demand on the system, particularly where it is operating near capacity.
- Offering discounts for all off-peak use or specific journey opportunities for off-peak use. The free travel by pensioners off-peak is an extreme example of this, with the operator being recompensed by the local authority, and the authority in turn with greater or lesser precision, by central government.

The Stage 2 model did assume perfect cross-subsidy on the network, so that all areas received similar levels of service in terms of wait-time and fare *etc.*. Generally, in a real commercial context, operators offer some cross-subsidy between their own routes, in order to be seen to offer a public service and to derive the commercial benefit of encouraging higher value cross-network trips. Cross subsidy is limited, however, as perfect cross-subsidy may impinge on profits, and it is a strategy open to being undermined by a rival entering the market solely to serve more lucrative routes on a lower cost basis, thereby winning market share and undermining the revenues which permit cross-subsidy in the first place. Again, to provide a consistent service, VPATS would tend to require some level of market protection, in the form of licensing the availability of the core technology, and requiring operators to accept a fair share of lucrative and less lucrative work within the system.

5.2. Towards a mature system

In Stage 2 Phase 3 (Scenarios 3a-5b), increasing numbers of bus routes were assumed to convert to operate flexibly within the VPATS portfolio, at first as a result of the public sector choosing 'best value' tenders¹⁴ which transfer a proportion of state-supported services, and subsequently as a result of the private sector offering VPATS coordinated services as well. To this end, Scenarios 4a & b reflected partial re-regulation of bus services and Scenario 5 alternatively represented the adoption of VPATS by a free market bus industry with entrepreneurial leadership.

There is also a moot point, as discussed in Section 4, as to how far private bus operators would choose to switch their commercial services to VPATS operation or submit tenders for supported services on that basis, without strong public sector leadership. However, it can generally be seen that the barriers to switching tendered (or franchised) services to VPATS are somewhat lower than for commercial services.

Key implementation issues emerge then as:

- making VPATS attractive to operators, whether being introduced to the market for providing supported or commercial services, and
- the effective integration of VPATS operations within the existing regulatory framework for buses (or seeking its suitable amendment), in the sense that VPATS services should be an attractive, realistic proposition in practice, not solely a legal, technical, possibility in theory.

¹⁴ I.e., tenders which are not necessarily the cheapest cost (although they may be) but deliver the highest cross-sector benefits for an acceptable level of subsidy.

Attractiveness to potential operators

The first of these issues has been addressed in part earlier in this report in terms of building market confidence. To date, the typical beliefs expressed by public transport operators have tended towards the view that new forms of flexible public transport seem plausible in principle, but they are concerned about the apparently poor commercial returns available in practice, at present. This doubt has been reflected in the paucity of bids received to run DRT operations, and in the relatively high cost of the eventual tenders (Radbourne, 2003; Armstrong, 2003). It is salient to reflect that both the commercially driven Yellow Taxibus¹⁵ and Truro Plus Bus experiments were only implemented under the direction of very senior management (Bunting, 2003; Crossfield, 2003). Even more revealing, is that the local Stagecoach subsidiary is understood to have entered a bid to run the Nexus U-Call service only when specifically directed to by Brian Souter, Chief Executive, Stagecoach Group (Usher, 2003).

Whatever the regulatory structure, VPATS operators would be concerned to understand the position of the services in relation to public subsidies in the form of Bus Service Operator's Grant to offset fuel taxation costs (which the scenarios assume VPATS attracts), and exemption from VAT.

Further, government - either national or local or both in combination – might offer some kind of fiscal incentive along the lines of the current DfT Kickstart funding. Alternatively, the public authorities might make a further significant simplification of the current operating regimes to stimulate the market.

These issues are developed further along with those concerning regulation below, first for supported services, followed by commercial services.

Implications of VPATS for tendered services

An early market niche for VPATS operators is likely to be as a contractor to the public sector, in providing socially necessary services to the public, school students, and for the transport of dependent individuals on behalf of social services¹⁶. There has been considerable local authority interest in flexible transport solutions in recent years, whether operated as flexible buses, taxi-buses, or on a shared taxi basis. To date, a common approach to dealing with operator reticence in respect of tendered

¹⁵ In this case, the experiment was an entirely commercial one, but ended after two years' trial, when it was clear that commercial viability would not be achieved. The decision not to pursue congestion charging in Edinburgh may have been one factor. However, this was a relatively small-scale, low-technology, known-cost and limited-risk scheme, aimed at meeting the needs of a very specific niche market, and is only a partial exemplar for the VPATS model, perhaps underlying some of the barriers to commercial market entry, rather than ruling out an entirely private-sector approach.

¹⁶ Galvin (2003) believed Computer Cabs Plc (CC) could play a greater role in achieving resource efficiency through co-ordination of underutilised social services, school, health and other LA transport services. One problem is that each service is let out separately for seven-year contracts that rarely coincide, so it is hard to plan the co-ordination across sectors. Furthermore each sector tends to defend its own budget and area. Notably, however, CC is large and part of a public transport group and so rather different to many other taxi operators in Britain, who tend to be small and think less strategically. Smaller taxi operators are likely to be risk adverse and not familiar with entering into partnership deals.

services has been for local authorities to bear all the revenue risk by issuing gross cost contracts. In practice, this has meant that the local authority buys or leases and brands the vehicles, plans the routes and then invites operators to bid to run the services for a fixed fee which they will receive no matter how many people use the service. Hampshire County Council and Nexus (Tyneside PTE) are two public bodies that have adopted this tactic, but both still report that despite this the tender prices received were far higher than anticipated (Armstrong, 2003; Usher, 2003).

Tenderers might *choose* to offer a number of journeys to and from eligible areas for a given quality and price¹⁷ through a VPATS-based tender submission for a particular contract. Such a tenderer would judge that the system usage costs would be more than outweighed by the benefits of optimised scheduling. Other tenderers might submit traditional bids.

Alternatively, a tendering authority itself convinced by the quality of a VPATS-based contract (in social and/or financial terms) might decide to seek VPATS-based tenders only¹⁸. Such a decision might be political, and would be important in transforming a local bus market, by persuading incumbent operators to engage with VPATS or lose market share.

The conversion of tendered bus services to VPATS would not necessarily require legislative change, as many tendered services are already provided on a low-tech demand-responsive basis. There are complexities associated with ensuring flexible services operate within the conditions of their registrations under the 1985 Transport Act and subsequent modifications, but practice is emerging in the sector with the assistance of the Traffic Commissioners as to how to maintain the public interest in the absence of traditional routes. One solution is the use of ‘mystery travellers’ to test whether claims and promises made by operators about performance are in practice delivered.

There may, however, be new issues emerging relating to competition. Where bus routes run in fixed corridors at fixed times then it is relatively easy to avoid providing unfair competition to commercial services through the presence of a subsidised service. However, where flexibly scheduled vehicles cover a wide range of localities, it will not be possible to isolate competition with commercial services on a simple route basis. Currently, most flexible services run in fairly rural areas or evenings-only

¹⁷ In practice eligible travellers might be offered a journey under the conditions of the tender agreement, which may specify collection from the nearest bus stop (unless the traveller is mobility impaired) but may have the option to pay extra for a door-to-door service.

¹⁸ Notably, the presence of a franchised network in London raises the possibility of whole or parts of the ten franchises being let for VPATS operation. In the first instance the heavy flows and particular importance of the large double-deck bus on some routes would suggest that VPATS would only replace traditional bus services in some suburbs. At times and places on the network for which Transport for London is not favourable towards replacing conventional bus services with VPATS coordinated services, it would have concerns about protecting revenue on those conventional services. Under current legislation VPATS could not compete with bus services in London by offering bus-type services, but could offer HC or PH services, provided the vehicles are suitably licensed. Given the range of VPATS operating modalities, however, it may be a moot point – requiring adjudication – whether VPATS would be able to offer carriage for individual fares in a shared vehicle. Notably, the taxi-sharing arrangement from London Paddington station is believed not to be strictly legal, although tolerated due to the taxi operating constraints, and perhaps because bus patronage is not significantly affected.

in larger urban areas, where there is little or no commercial competition. In those circumstances, flexible operating areas can be quite large but still receive public subsidy without risk of contravening competition legislation. In urban areas during the day, however, it is likely that any localities which are provided with socially supported services, *i.e.*, particular pockets of deprivation, might be sufficiently close in space to commercial bus routes to provide competition. Hence, it might be necessary to limit the application of social subsidy to VPATS fares when it operates in bus-like mode to a subset of origins and destinations, so that subsidy is only provided where a conventional bus was not available. However, given the high technology of the VPATS approach, this should be a possible constraint to incorporate.

Whilst new legislation may not be necessary to permit tendered services to operate under VPATS, there is clearly a shift from supporting 'the route' to supporting travellers from particular areas. Given that current subsidy arrangements are not efficient, with some travellers receiving subsidised fares for which they were willing and able to pay, there would be arguments for changing the basis of support to target needy travellers, rather than needy neighbourhoods. With a VPATS-type technology in place, the marginal cost of providing a journey from an area not covered by a conventional bus service would fall, turning the policy problem from 'how to provide a bus schedule for a range of traveller types' to 'how to extend the affordability of VPATS for specific needy users'. Such a change in allocating subsidy would at once:

- facilitate the introduction and efficient operation of VPATS,
- potentially reduce subsidy costs, and
- target the provision of subsidy towards the needy on a more efficient basis.

Government did recently conduct a review of subsidy to bus operators, and considered altering the basis of payment from per bus-km travelled to per passenger boarding. Such a change was ruled out from current government policy in the 2004 White Paper¹⁹, although calls for a further review on the grounds of efficiency and better targeting of social, environmental and economic objectives continue.

Implications of VPATS for current commercial services

As noted in Section 3, theoretical economics suggests there may be difficulties with a new technology – even one with clear long-run social cost benefits – breaking into the current market. Furthermore, the introduction of VPATS by an incumbent or new-entrant operator is likely to result in competition for the market, even in the current bus sector characterised in many places by a tendency to local monopoly or duopoly. This is due not least to the fact that VPATS would tend to operate on an area rather than route basis, so it is more likely that operators' market areas will overlap existing route-based catchments. To the problems of market entry, then, is added the dilemma that a competitive response may result in the duplication of some

¹⁹ The White Paper concluded that "the benefits to be gained from any change are not certain enough to justify the costs and disruption at a time when we want operators to focus all their energy on improving services for passengers" (DfT, 2004: 70).

assets and a certain amount of over or under supply in the market, at least in the short-run.

In practice, though, bus deregulation has shown that competition in the market for bus services has often (but not always) been weak, as consumers derive more benefit from reducing waiting time by getting the first bus to arrive at a stop than they do value from the relatively small amounts of money saved, or in comparison with the benefit of enjoying slightly better comfort by waiting for a different company's bus (about which there may be a level of uncertainty about when, or if, it will arrive). This situation will tend to favour larger operators capable of providing higher frequency on a particular route (which may then be reduced once a competition withdraws).

Furthermore, VPATS will draw in operators from the pre-booked PHV market, in which competition for the market is much more about the effective promotion of specific contact points with the system (phone, email), and subsequent brand loyalty where the 'brand' is often a memorable phone number on an attractive card, rather than informed consumers choosing between different taxi products. Vehicle quality and fare levels are strongly standardised in any case through the local licensing conditions. In the case of HCs hailed on the street or rank, competition is further restricted by the rigid enforcement of allocation by the taxi queue, which eliminates consumer choice²⁰.

The general weakness of competition in the market in practice is one reason why proponents of some degree of re-regulation of bus services have remained prominent since the 1985 Transport Act was passed, and despite some legislative revision with the Transport Act 2000. As a result of this Act, one model of VPATS implementation would be for the local public transport authority (county or unitary), or possibly a collective of authorities, to specify an area to be covered by a 'quality contract'. A single operator could then be licensed by agreement or tender, and the requirement to participate in VPATS arrangements could be part of such an agreement. Although the Act envisages conventional bus routes, it also foresees those routes covering defined spatial areas, which suggests that flexible bus services could be coordinated by VPATS under the powers of the Act.

However, six years after the Transport Act 2000, no local authority has succeeded in implementing these powers. The 'Quality Contract' provisions empower councils to take control of the planning of the local bus network and invite bus operators to tender for the rights to run it where existing bus operators can be shown to be performing poorly. This is an onerous requirement: Section 124 (1) of the Transport Act 2000 in fact states that:

"A local transport authority, or two or more such authorities acting jointly, may make a quality contracts scheme covering the whole or any part of their area, or combined area, if they are satisfied that -

²⁰ So much so that the 'taxi rank principle' has entered into more general linguistic usage as the means by which barristers are traditionally allocated to a legal brief – attractive or otherwise - without selection or favour.

(a) making a quality contracts scheme is the only practicable way of implementing the policies set out in their bus strategy or strategies in the area to which the proposed scheme relates, and

(b) the proposed scheme will implement those policies in such a way which is economic, efficient and effective”.

These clauses suggest significant legal scope for a private bus company opposed to contractual arrangements to argue that the *status quo* is more likely to achieve implementation of the bus strategy of the Local Transport Plan than changes to the basis of bus service provision which may create temporary disruption. Even if the case for a contract is accepted by the Secretary of State – possibly following lengthy legal argument - six months’ notice is then required before the contract is established.

There is also concern amongst local authorities that a ‘quality contract’ would be doubly-binding, with the local authority obliged to deliver specified infrastructure or operating environments despite possible changes of political commitment, or find itself in breach of contract.

Furthermore, the success of weak-hand regulation in the most successful English bus cities outside London, such as Brighton, York, Oxford and Cambridge, will be presented as counterarguments for regulation. In these cities steady, incremental growth in market share has been achieved by matching local authority investment with voluntary ‘quality partnership’ commitments from the local bus operator, such as the provision of new vehicles, relying more on trust and persuasion than contract, although such agreements may be codified by non-binding letters of intention.

A further factor supporting ‘mutual incrementalism’ over strong intervention is the relationship between government and commerce, and the bus industry in particular. The industry is dominated currently by five major bus companies, which are themselves parts of major commercial groups with other interests, notably in the rail and car leasing sectors. In this context it is notable that quality contracts have to be approved by the Secretary of State, but the Labour Government has been keen to avoid decisions which could suggest that its policies have a conflict of interest with the free market; hence the avoidance of overt re-nationalisation of the rail industry and decision to compensate Railtrack Plc shareholders following the transformation of the private company to trust-status Network Rail. However, commercial interests are not all identical, and the major financial institutions are also showing a growing interest in public transport assets, and may value stability over market growth²¹.

Government has made it easier for local authorities to introduce them, for example the interregnum from *status quo* to quality contract had previously been 21 months rather than 6 months. Another measure will assist Passenger Transport Authorities in the designated Metropolitan areas in contracting rail-replacement bus services where they could offer a more effective service than existing rail services and feeder-

²¹ Notably, the Australian investment bank Macquarie recently bought Stagecoach London for £263 million. Transit (7/7/06) reports that other investment banks are currently interested in the public transport sector, but notes also that the London operation was of particular interest due to the low risks of the regulated market.

bus rail services, for example in association with new light rail lines introduced at high public capital expense.

These changes may increase the opportunities for VPATS being trialled, particularly in a rail-related niche. However, outside of these PTA niches it seemed until recently that Section 124 of the 2000 Transport Act is only likely to be implemented in fairly rare situations in which it is imposed because joint-working between a local authority and the local bus companies has deteriorated to such a significant degree, or the financial or organisational health of the only significant private bus company is so poor, that it can be successfully argued that a contract is the only last-resort way of achieving local transport policy objectives. Whilst it might be argued that these relatively rare cases might provide fertile ground for radical new thinking, the counterview is that these examples are likely to be those least suited to successful public transport operation of any kind, so not an effective way to build market confidence.

In early 2006, however, a number of developments suggested tighter regulation is likely in the future, including:

- a 'market consultation exercise' into possible quality contracts launched in January by the Passenger Transport Executives for Tyne and Wear and South Yorkshire, to which they reported in April a positive response from potential operators, with the proviso that the PTEs expected to take revenue risk if they go ahead, at least in the first instance, in order to maximise tender participation²²;
- the House of Commons Select Committee on Transport initiated an inquiry into the success or failure of the 1985 Act in May, with a broad remit to consider possible improvements to the regulatory framework, but also the role of the Traffic Commissioners, and the implications of free concessionary fares for pensioners;
- also in May the Association of Transport Coordinating Officers, which represents more than 700 local authority transport officers re-launched its campaign for 'quality networks' a variant on the quality contract model which would enable specification of fares and frequencies in return for greater infrastructure provision, but also retain the possibility of new market entrants at specified intervals²³;
- the former Secretary of State for transport Alistair Darling was reported as seeking more local authority influence on service provision and reduced constraints from competition legislation on the coordination of fares and services, whilst avoiding further moves towards the contractual approach²⁴; and
- under the new Secretary of State – Douglas Alexander – the Department has appeared to go further, with the Junior Minister Gillian Merron suggesting in July that legislation for greater regulation could be introduced as early as 2007²⁵.

²² Transport Times 13 1 06 p1 and 21 4 06 p1

²³ Transport Times 19 5 06 p1-3

²⁴ Transport Times 10 2 06 p1 and 5 5 06 p19.

²⁵ Transit, 7 7 06, p1

Whilst politics are likely to play an important part in the outcome of this parliamentary - and *de facto* government - review, it can be noted in general that adversarial, contractual contexts are unlikely to produce the conditions necessary for effective entrepreneurship and investment on the part of either the private or public sector, or both. Arguably, change as radical as introducing VPATS will only be achieved if risk – at least in the long run - is shared on a partnership basis, whether voluntary or contractual, with both operator(s) and council(s) achieving a working relationship which exists despite contracts, rather than because of them.

More specifically, it is suggested that the ATCO proposals might offer a close fit with the needs of VPATS, being couched in terms of general regulatory conditions applied to areas, with the explicit possibility for new market entrants allowing the potential for the new technology to stimulate new kinds of demand and supply.

5.3. Maximising the social benefits of VPATS

Finally, Stage 2 Phase 4 (Scenario 6) of the current research presents VPATS as benefiting from a significant transfer from private cars, due to major policy change, such as the introduction of road user charging, now under consideration again for the Greater Bristol area as part of a forthcoming bid to the DfT's Transport Innovation Fund for capital investment to reduce congestion in the former Avon area.

The key objective here would be to make VPATS attractive to current travellers who exhibit strong car dependence.

The full set of policies and initiatives to enhance modal shift from car is beyond the scope of the current research, and in any case is well considered elsewhere (e.g. Docherty & Shaw, 2003). In summary, though, changes to planning policy and local transport policy in the UK in recent years have moved the balance of measures somewhat towards public transport, at least in urban areas, through the encouragement of restraint on parking supply and bus priority, although in many cities car use still remains an attractive option.

In essence, it is generally established that the alternative modes will need to be strongly promoted, and knowledge within the sector about how to achieve this most effectively is growing (TAS Partnership, 1997; Enoch and Potter 2002), but also that car use needs to become relatively less attractive, either through physical traffic management measures, such as bus priorities which reallocate road space, or economic measures, notably moving closer towards a marginal social cost pricing approach to car travel, through some kind of road user charging scheme.

As noted above, the introduction of the 'Transport Innovation Fund', expected to be worth £290 million in 2008/09, rising annually to over £2 billion by 2014/15, may offer a specific funding context which could simultaneously increase the attractiveness of VPATS whilst reduce the attractiveness of car use. The funds will be available for two kinds of scheme, leading either

- a) to congestion reduction, and in practice requiring the introduction of new motoring charges (usually road user charges, but possibly workplace parking charges) or
- b) an increase in the contribution of transport to national productivity and international competitiveness, with an emphasis on labour market flexibility and reducing transport costs to business.

Flexible transport services such as VPATS could address some of the specific topics mentioned in the examples for which TIF funding could be available (DfT, 2006), such as, in the case of the productivity objective,

- increasing the mobility of people or goods in order to reduce business costs and
- supporting the mobility and flexibility of the labour market,

and, in the case of the congestion-reduction objective,

- measures to encourage modal shift and manage demand, such as improved public transport, with the role of sophisticated information systems acknowledged.

However, the two funding routes are parallel, rather than integrated, so VPATS would need to be posited as central to one of the two overarching objectives, not partly relevant to both. Further, the funds will be largely targeted at high-value schemes or packages, addressing relatively large areas, from the sub-region upwards.

One issue that would need to be addressed is to what extent VPATS vehicles would be subject to road user charges. Buses are currently exempt in London, whilst taxis are charged. The basis of charging (per day or per trip or per mile *etc.*) would be important. From a highway management perspective, VPATS vehicles are likely to be much more numerous than current bus fleets, which suggests the case for them to be liable to any road user charge is strong. Furthermore, in economic terms, system efficiency is likely to be optimised where journeys that can be shared are shared, and this would be promoted by a charge levied per vehicle – as is most likely - rather than per passenger.

Another outstanding issue is how far car users should be encouraged to use cars as an access mode to VPATS, for example in the case that VPATS is available near the destination but not the origin of a journey. P&R schemes have been associated with particular economic inefficiencies and traffic generation problems due to the car parking infrastructure and travel services being offered to users at much below market price. The resultant market signals have encouraged trip attraction and generation, and modal shift from public transport to P&R journeys for which the majority of travel is completed by car (Parkhurst, 2000). A VPATS-based system is more likely to be directly accessible from a user's home than current public transport, so may in fact reduce the demand for P&R, but where it does exist, the parking element of the attribute bundle should be offered at least at full private cost, if not full marginal social cost.

6. Conclusion and Recommendations

In conclusion, this Stage 3 report has reviewed the literature on travel poverty, with the finding that it remains significant, and multifaceted; it cannot be reduced to an issue of ability to pay (although that is a significant factor), as those on lowest incomes are amongst the most intense users of relatively high-cost taxi services. It can be concluded that VPATS would in principle increase the choice offered to the travel poor by virtue of its flexible modality and range of cost options. In particular it could extend the availability of 'shared taxi' type services, which are currently only offered at a few intercity railway stations and airports, mostly to the benefit of the 'travel rich', and in some rural areas. At the same time VPATS would retain the bus-type options, enabling the system to run more efficiently and the time-rich-money-poor traveller to save money and gain exercise by walking to/from pick-up/set-down points. It would also retain the exclusive use option which would be used also by money-poor-but-time-poorer travellers on particular occasions.

The development of the core VPATS technology itself might conceivably be stimulated by national government policy and funding, perhaps with an element of competitive participation, with the expectation that one technology will ultimately be commissioned for implementation. Alternatively, if the commercial sector chose to take the lead, then government might seek to issue a limited number of licences, possibly by auction, probably on a local or regional basis. These might be local monopoly suppliers of VPATS technology, as in the case of water supply, to avoid the costs of duplication, or there might be competition, as in the case of the mobile phone or energy markets.

Implementation as a transport facilitating service will require the right balance of regulation and free-market enterprise affecting the participant modes. The right level of regulation will encourage institutions to invest in the VPATS infrastructure and operators to plan for its use. However, the system may need to remain open to entrepreneurship if the full benefits of the novel technology are to be exploited.

The introduction of VPATS would not necessarily require legislative change, particularly as there are available statutes for quality contracts which have not yet been applied in practice. The introduction of VPATS is though likely to be facilitated by legislative changes which take it into account. Specific regulatory issues are:

- the complexity of the current multi-level system involving local authorities and traffic commissioners, which are not insurmountable barriers but are likely to add some administrative cost and inefficiency, and
- the appropriate framework for bus regulation as it applies to flexible bus services, as many of the attribute bundles that VPATS would wish to provide would tend to replace bus journeys, but might not be legally designated as bus services under current legislation, and so would not be eligible for Bus Service Operator's Grant or VAT exemption.

The promoters of VPATS are recommended to observe the debate underway on bus re-regulation, with a view to lobbying and submitting evidence should it become clear that new legislation is likely.

In the interim period prior to implementation the development of a public transport system suited to VPATS management is likely to be enhanced by steps including the following:-

- The adaption of local taxi regulations to encourage and promote the practice of sharing taxis, with public support offered for facilitating infrastructure and information provision.
- Where services are supported by tenders, the relevant call documents could actively encourage flexible transport solutions.
- Local authorities developing the vehicle brokerage role, for the provision of specialised education and health sector transport services, involving leasing to the private sector where appropriate.
- Public support and funding for the application of interoperable technology to all public transport modes, in a way that creates the operating basis for a VPATS network (*i.e.*, vehicle tracking and identification systems; common, high-tech dispatch systems).
- Encouragement of investment by private bus industry in high frequency services, through informal partnerships or more formal contracts, which create in turn more favourable, profitable circumstances for public transport operation.

Further, interested local authorities might begin to set out the role for VPATS in the overall strategic long-term objectives for local transport policy, so that private sector operators can make investment decisions in a stable, informed context. It will also need to introduce associated transport policy measures to favour public transport over private car use, notably new car user charges, and to integrate VPATS with walking, cycling, longer-range public transport use and car use and market both the strategy and the services far more effectively than has typically been achieved in the public transport sector to date. VPATS will need to be 'sold' as facilitating 21st Century lifestyle choices, as being inclusive and respecting the environment, and at a cost to the state that is attractive and an average price to the consumer that is financially viable.

In terms of where VPATS might be applied first, it is seen as most likely to develop in a bottom-up way from isolated cells based on specific taxi licensing areas or local transport plan areas, which in time will become integrated. Whilst the regulation of buses in London may simplify some issues, such as competition, it is ironically perhaps too regulated, subject to too many novel implementation projects already, and is too committed politically to established modes to be an obvious pilot area.

It is recommended that the most fruitful route to implementing VPATS would be to develop the model in partnership with a specific local authority outside London, with good relations with the dominant transport providers in its area, and with strong aspirations to develop local public transport, but which perhaps is experiencing market barriers to these objectives. A policy for high-tech management of the local transport system including both VPATS and road pricing for vehicle movements might then be the basis for an LTP or TIF funding bid.

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