

THE EXISTING AND FUTURE ROLE FOR DEMAND RESPONSIVE TRANSPORT SCHEMES: LESSONS FROM A SURVEY IN GREAT BRITAIN

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Abstract

Despite the role of public transport in meeting an ever expanding range of policy goals, lifestyle choices and land use patterns present challenges in meeting the needs of a large section of the population. Furthermore, the recent economic uncertainty has exerted further pressure upon budgets for subsidising provision. As a result, there is a need for cost-effective modes of transport that can operate effectively in areas and at times where demand levels are lower. Such modes include Demand Responsive Transport (DRT). However, relatively little research has been carried out to determine how, why, when and where DRT services function effectively, particularly in more developed countries.

Consequently, the aim of this paper is to examine the characteristics of schemes across a range of different contexts to identify the type of schemes most prevalent according to institutional and geographical circumstances, based on a survey of DRT schemes in Great Britain. Through examining the scheme design, performance and rationale of these schemes this paper will emphasise the likely futures of DRT schemes in a climate where budget cuts are in some cases leading to funding reductions or withdrawn services. It will also explore the conundrum that in some cases such reductions impact negatively on DRT provision in others the withdrawal of bus services can produce a positive impact on DRT, as there is greater demand for such flexible services, to better explain the reasons behind this. Implications in terms of DRT in an Irish context will be discussed, given the current priorities of achieving a sustainable and inclusive transport system.

Introduction

The global economic crisis that began in the U.S. in 2007 has impacted heavily on public sector finances. In the United Kingdom, the response of the newly elected Conservative Liberal Coalition Government in October 2010 was to announce cuts of £81 billion of public spending by 2015 [1]. Subsequently there have been significant repercussions on, amongst other things, subsidising commercially unviable but 'socially necessary' bus services. This has typically had the greatest impact in less densely populated areas. For example, in Northamptonshire County Council a £3.1 million rural bus subsidy grant was replaced with a budget of £1 million [2]. In addition, wider societal trends, including a rapidly ageing population and potentially far higher levels of unemployment, coupled with still rising car use (and its associated impact on increasing levels of car dependence in the form of, for example, lower density development) are combining to ensure that the need for non-private car-based transport is becoming increasingly important, although the ability of trains and buses to meet those needs is actually decreasing. As a consequence, the search is on for alternatives to 'conventional' public transport, in particular buses with fixed timetables and fixed routes, such as Demand Responsive Transport.

Demand Responsive Transport (DRT), broadly similar to paratransit in the USA, can be defined as being 'an intermediate form of public transport, somewhere between a regular service route that uses small low floor buses and variably routed highly personalised transport services offered by taxis' [3]. Whilst recognising that other forms of DRT, such as dial-a-ride do exist, this paper will focus on DRT whereby: the service responds to changes

in demand by either altering its route and/or its timetable; the fare is charged on a per passenger and not a per vehicle basis; and the service is available to the general public (i.e. it is not restricted solely to particular groups of user according to age or disability criteria).

DRT is most common in countries where institutional and/or land use factors prevent conventional buses from meeting demand [4, 5], in such situations they operate on a commercial basis. However, there are a few exceptions, for instance airport feeder services have proven commercially viable in US and Europe, but not the UK, as have other niche markets, such as Black Taxibuses in cities in Northern Ireland introduced to provide a transport option during the troubles [5]. Despite the limited commercial success DRT continues to be a popular strategic option in creating access and encouraging social inclusion both with GB [6] for example it is also recognised as a practical solution in Northern Ireland [7] and Ireland [8]. As a result of such attention pilots have been funded by government bodies [9, 10]. This leads to concerns about the longevity of DRT provision, the introduction of services which respond to funding criteria rather than local need [11] and linked to this an emphasis on innovative schemes may mean that the service provided is over-specified and therefore difficult to sustain long term [5]. Brake et al. [12] suggest that for DRT to be commercially viable in the UK and Europe providers of flexible transport options should pool resources and work in partnership to cater for need. Another solution is to price DRT fares to better reflect the service provided, as is the case for commercial services in the US. This in turn could attract commercial operators, who are generally absent from the UK market. Ambrosino et al. [13] also highlight that, whether commercial or subsidised, competition between transport providers presents a challenge in introducing DRT as an alternative to taxis and buses, a barrier which is most prevalent in urban areas.

The survey presented in this paper builds upon a similar, 2005, data collection effort by Laws et al. [11]. This earlier survey focused on a list of DRT schemes registered with the Department for Transport. Scheme-based survey questionnaires were sent to 36 authorities, responsible for 99 registered schemes. Twenty-eight authorities replied, providing a response for 48 schemes (a response rate of 48%). This survey identified that the main motivations for introducing a scheme were social or related to funding availability, as a result of the rural and urban bus challenges funding streams, which provided funding for innovative transport measures to meet social need. The primary scheme objective in most cases was to promote social inclusion. Of the schemes surveyed, just over half of schemes required a subsidy of over £5 per person per trip with those operating in rural areas requiring higher levels and being less cost-effective than those with suburban or urban elements. However rural areas are often where the need for public transport is greatest, to provide access to core facilities and the wider public transport network, particularly amongst population segments without access to a car [14].

Research Design

Survey recruitment in this study involved public transport officers in Great Britain representing Transport for London, Passenger Transport Executives, responsible for transport policy and planning metropolitan areas, county councils and unitary authorities. The survey was also distributed to CT operators, though as Nutley [15] highlights, identifying such organisations is challenging. The survey took place between March and October 2011. Contact was initially made by telephone and then a link to a web-based survey was emailed to the most relevant person. Non-respondents were contacted a further two times, firstly as a reminder, and secondly to arrange a time for a telephone interview. The survey was also publicised via trade publications and respondents were encouraged to share the link with relevant contacts.

The survey expanded on the approach used by Laws et al [11] by focussing more on the organisations than the schemes, thereby examining how decisions are made regarding public transport service delivery options. The survey questionnaire also collected a range of scheme level data to allow comparison over time. The following sections are based on a response from 63 governmental organisations and 11 community transport operators. The former equates to a response rate of 35% from authorities responsible for strategic transport planning across Britain, the latter received a far lower response rate though it is not possible

to include a percentage value as the total number of CT operators is not known. Response by organisation type and region is summarised in Table 1.

TABLE 1 Survey response

	<i>Community / voluntary transport</i>	<i>County Council</i>	<i>Passenger Transport Executive</i>	<i>Unitary authority</i>	<i>Total by region</i>
East Anglia	-	4	-	2	6
East Midlands	-	5	1	4	10
North East	-	-	-	3	3
North West	-	-	1	4	5
Scotland	2	-	-	9	11
South East	-	4	1	5	10
South West	1	2	-	6	9
Wales	6	-	-	4	10
West Midlands	1	2	-	3	6
Yorkshire and the Humber	1	1	1	1	4
Total by authority type	11	18	4	41	74

Survey results are analysed using descriptive statistics as the low population size results in a sample which may not allow for detailed statistical analysis. For qualitative data, where response allowed, data is categorised and summarised statistically; discussions include verbatim responses to emphasise survey findings.

Demand Responsive Schemes in Britain

This section provides details of previous, current and future DRT schemes in Great Britain based on response to the survey, as summarised in Table 2.

TABLE 2 Number of Passengers and Trips per Annum

	<i>Responses</i>	<i>Average</i>	<i>Range</i>	<i>Total</i>
Previous schemes	23	2	1-6	34
Current schemes	59	6	1-41	369
Future schemes (planned)	19	2 ^a	1-5	22
Future schemes (unplanned)	20 ^b	N/A	N/A	N/A
Total				425

^a 7 organisations are yet to decide the number of schemes to implement so this average is based on 12 organisations with respect to future planned schemes

^b 12 of the organisations involved in future, unplanned schemes are also involved in future planned scheme

N/A = Not applicable

Most organisations first got involved in DRT in 2001, coinciding with input from central government. One organisation reported involvement from 1986. The majority of current schemes were introduced between 2007 and 2011, though the earliest reported scheme started in 1983. The majority are 'ongoing', or the end date is not known, however 11 are up for review in 2011, 20 in 2012 and one each in 2014, 2015, 2016 and 2021. The future planned schemes were intended to be launched within 12 months of response, though organisations may be involved in further schemes over the next 12 months, often in response to withdrawal of conventional services.

When reviewing the number of schemes, it is worth noting that this figure is influenced by the role the organisation had in provision, in particular whether it was strategic or operational. Being a flexible mode of transport, of the 59 organisations reporting on current schemes, 17 organisations report planned changes to existing services, either in the form of expansions, for 13 organisations or reductions or withdrawals for 5 organisations, three of which are expanding in some areas whilst detracting in others.

Design of DRT schemes

In Britain companies using vehicles with nine or more seats for 'hire or reward' require a Public Service Vehicle (PSV) licence, a condition extended to all vehicles when companies expect each passenger to pay individually [16]. Organisations without a view to profit, such as CT operators, can operate under the permit system [17]. Here there are two options, a section 22 permit, which allows the community transport operator to provide a local bus service, available to the general public, and a section 19 permit, which restricts users to defined groups. It is also possible for DRT schemes to be registered as a minicab, being licensed as a private hire vehicle (PHV) which must be pre-booked or a taxi or 'Hackney Carriage', where pre-booking is not required. Of 76 schemes reported on in detail, 27 schemes operate under a PSV licence, 24 with section 19 permits, nine with section 22 permits and 14 are licensed as 'taxis' – eight as PHVs and six as Hackney Carriages. The remaining two schemes are not licensed as a result of the type operation.

Licensing influences the vehicles used. With a few exceptions schemes operating under section 19 are restricted to minibuses, vehicles with 16 seats or fewer, and section 22 or PSVs are often available for minibuses or buses, though more recently PSV licenses have been expanded to registered cars. Therefore, 43 organisations operate DRT using minibuses; 14 organisations operate using buses and 14 organisations operate using cars. Whilst the majority of vehicles are accessible for users with limited mobility, this is not always the case for the cars, with the exception of those registered under the Hackney license.

Also related to licensing, organisations require users to register for 39 of the schemes and 23 schemes are restricted to specific user groups, with restrictions defined either by area or by population segment. In most cases this is because the scheme is operated under a section 19 permit, but in a few cases it is to ensure local residents benefit from the scheme. In response to the survey, few respondents identify service registration as causing any problems, though a number highlight that recent changes to registration have supported service introduction, for example the possibility for CT operators to opt use paid drivers on services available to the general public, rather than relying solely on volunteers.

Technology plays a number of roles on DRT provision, the largest contribution identified through this survey is communication focussed, with 37 organisations using technology for call centre bookings and also for communicating with the driver (29 responses). It also plays a function in vehicle management, being applied to routing (23), allocation (19) and tracking (15). Organisations use in-house facilities and programmes, coordinate provision with other authorities or purchase the relevant software. Common software providers are Mobisoft and Trapeze.

For non-concessionary fares, the per trip fare level ranged between a £1.00 and £8.00. Of the 52 schemes, for which fare information was provided, 38 accepted concessionary fares. For three of the schemes, this equated to half fare, but for the remaining schemes concessionary fares were free to the user, being reimbursed from national or local government funding sources. This is significant as organisations report that for 31 DRT schemes in excess of 75% of passengers are eligible for concessionary fares.

Thirty-three respondents report that one or more of their schemes, is designed, or capable of acting as a feeder route for other forms of public transport. This is achieved either officially as part of the scheduled design or unofficially when sensible connections occur. Furthermore 24 respondents report that DRT schemes are coordinated with other transport provision, to cater for adult social care and educational needs, which includes special educational needs, post 16 and mainstream education; similar to the types of services provided through a human services agency in the USA. The main reason for doing this is to increase the viability of the service through fixed financial investment, particularly when public demand is low, or alternatively to make best use of resources or reduce overall costs. The coordination is achieved either by accommodating users on public DRT or, by reserving vehicles as required.

Performance of DRT schemes

Table 3 summarises demand for 2010 (or in some cases the 2010/11 financial year): across all schemes; for the most costs effective scheme; and for the least cost effective scheme.

TABLE 3 Number of Passengers and Trips per Annum

<i>Schemes</i>	<i>Indicator</i>	<i>Responses</i>	<i>Average</i>	<i>Range</i>	<i>Total</i>
All schemes	Passengers	29	13,106	50-180,000	380,073
	Trips	37	43,459	1,000-270,000	1,607,998
Most cost effective scheme	Passengers	22	3,793	10-24,000	83,446
	Trips	26	15,577	100-80,000	405,012
Least cost effective scheme	Passengers	9	1,082	20-5,569	9,738
	Trips	14	4,499	300-12,748	62,986

Demand for DRT is identified as providing a *'business case'* for provision *'particularly in rural areas'*, but respondents highlight a need for awareness amongst suppliers and users. Suppliers need to be aware of what the demand is *'to make sure it's there'* and how best to provide for it, and users need to know that such schemes exist. There is a public concern that withdrawal of a bus service can result in an isolated society. Respondents highlight that *'understanding how schemes work can be a barrier when replacing conventional bus services'* so raising awareness is important in ensuring success. Communication and marketing from initiation and throughout the life of the scheme is the key in ensuring DRT is *'positively received'*.

In assessing a scheme as being cost effective the majority of respondents refer to low levels of subsidy per person or high occupancy rates: *'[DRT is] most established with a lower per passenger subsidy and higher usage'*. This is also identified as a function of design, for instance, services that do not operate when not booked, or when the level of flexibility provides most efficient use of vehicles: *'We provide a fully demand responsive service, with the flexibility to schedule multiple passengers to one vehicle through an effective booking system.'* Both technology-based and manual booking systems are identified as elements of a cost effective service, though one example in particular highlights the benefits of using taxis: *'Taxibuses have very competitive operating prices, plus the booking function is achieved at a near-zero additional cost on top of core business of taxi firm.'*

Less cost effective services are identified, in part, for opposing reasons: *'High cost and low vehicle occupancy'*, which can occur when forecasted demand is higher than actual demand. Alternative reasons are driven by service design and the target audience. Providing vehicles to high specification, computerised booking and long operating hours are identified as requiring upfront investment *'However, these costs were considered necessary to get quality and accessibility of service'*. Furthermore, in another case capital front end costs are expected to take *'A 3-year period to become sustainable and generate funds to replace older vehicles.'* Also, with certain target groups, e. g. journeys to the hospital, the high cost of the journey can reflect the user needs, for example door-to-door provision and trained personnel accompanying the passenger(s) and be justified on that basis. As illustrated in Figure 1, per trip subsidy for provision ranges between schemes operating without subsidy to in excess of £20 (the highest subsidy reported is £93 per trip, although the second highest is £34), the majority receive £2.01-£5.00 or £5.01-£10.00 per trip.

As detailed above, 23 of the respondents have been involved in DRT schemes which have ceased operation. The reasons that services were withdrawn relate mainly to funding availability or the levels of demand often being too low, or in a limited number of instances to high. Specific reasons include: *'being replaced by a fixed route service'*, *'DRT didn't work as well in an urban area'* and *'over complex design and operating model'*.

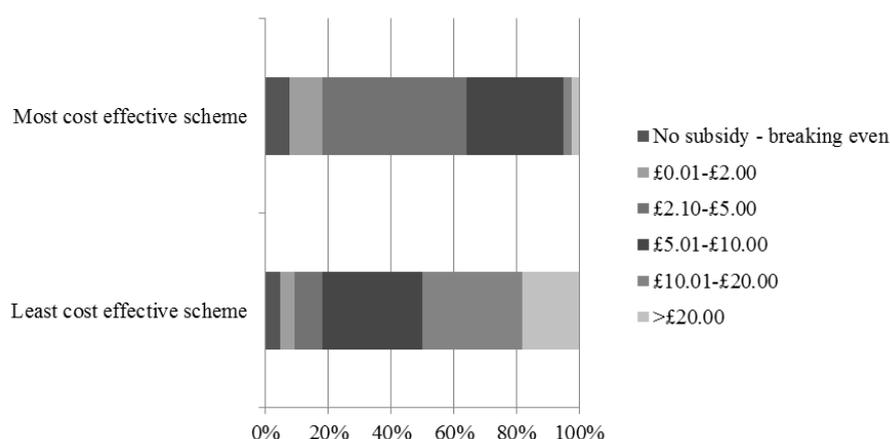


FIGURE 1 Per trip subsidy level

Rationale for introducing DRT schemes

A key influencing factor on the introduction of DRT is the response of local politicians. In cases where the members are supportive of the scheme then they push it forward, whereas if politicians prefer a conventional bus service for their constituents it is difficult to transfer investment to DRT. The main reason that DRT schemes were selected over more conventional public transport can be classified as responding to: the withdrawal or unavailability of a service bus; the rural nature of an area; and the mobility needs of passengers.

Cost effectiveness is highlighted as essential when selecting DRT as a transport option, for some authorities introducing DRT schemes is a way to provide public transport in response to budget cuts. *'The requirement to reduce the local bus budget by £1m has led to the need to consider DRT against withdrawing of services completely.'* Though, in a small number of cases funding availability has made it possible to introduce such schemes. Funding availability is identified as *'the primary enabling factor'* in ensuring DRT scheme success, revenue funding streams are recognised as particularly important in influencing the scope of DRT provision: *'Capital funding was key in getting very high quality accessible buses but revenue funding is very challenging and can limit scope'*. The initial funding sources included central government who funded, or part funded, 18 of the schemes reported on, the county councils or passenger transport executives, who funded 24 the unitary authorities, 36, and district or borough level councils who also funded, or part funded, 8 of the reported schemes. A small number of other organisations, including primary care trusts, emergency services and charities provided initial funding for 13 of the schemes. In a number of cases this initial funding has now finished, at least in part, or is due to finish shortly but further funds have been sourced. Secondary funding is most commonly from internal council budgets, fares and in a small number of cases a trip generator. In some cases these funds are ongoing for as long as they are assessed as value for money in provision and / or meeting targets.

Objectives for introducing specific DRT schemes can be summarised under the categories geographical, social and economic, (three of the four categories introduced by Laws et al. [11]). As illustrated in Figure 2 DRT is generally effective in meeting such objectives across each of the categories. Where:

- 'Geographical' relates to providing accessibility, including when conventional bus services have been withdrawn, for example, *'To improve access from rural areas'* or *'To replace bus service'*;
- 'Social' refers to providing for the social need of a population or a segment of the population, for example, *'Supporting people to live in the community'*; and
- 'Economic' refers to DRT being introduced in order to provide a more cost effective, or affordable service, for example, *'better use of subsidy funding'*.

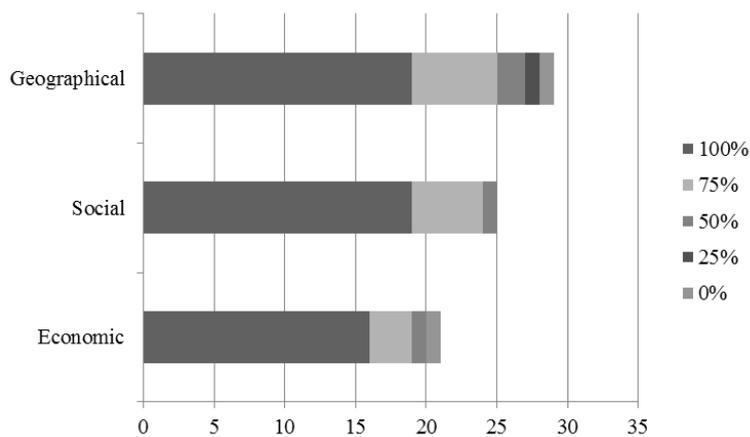


FIGURE 2 Scheme objectives by category and the extent to which they are being met

As highlighted above a small number of these objectives are not being adequately met, whilst the objectives cover the range of categories. The reasons for not being able to meet them are predominantly cost related.

Perspectives on the future of DRT in GB

Over recent years the design, performance and context of DRT has changed in order to better provide for demand and the needs of the passenger. These changes have a strong influence the future plans for DRT and include greater investment in planning and consulting at the design phase, with an emphasis on a 'bottom-up' approach; merging of services to create economies of scale and reduce duplication; and awareness raising using a peer-to-peer marketing and education.

The future of DRT is, however, uncertain due to reduced funding. Respondents saw two possible outcomes as a result of this:

1. DRT schemes are withdrawn, either
 - Generally '*Unless passenger numbers can be increased, DRT could diminish*'; or
 - Specifically: '*All DRT is likely to cease in 2012 due to withdrawal of funding*'.
2. DRT schemes increase, either:
 - In response to an decrease in investment in fixed-route bus service provision, '*I predict an inevitable growth as local authorities are forced to make more savings*';
 - As a result of the increased focus on third sector contribution to local services: '*The Government's "Big Society" (<http://www.cabinetoffice.gov.uk/news/building-big-society>) may lead to an increase*'; or
 - To cater for the needs of a less mobile population '*It may expand to cope with increased demand among people with impaired mobility*'.

This is, in effect, an outcome of the economic downturn and the decreased investment in public services. Where DRT remains, local authorities recognise it as primarily meeting rural demand, remaining a niche market product into the future. The main reason for this is the relatively high cost of providing conventional forms of public transport as a means of meeting the low and dispersed demand patterns of rural areas. Ways in which limitations can be overcome relate mainly to funding availability. Possible sources identified include central government, local government and passenger fares through increased usage. One local authority reports that whilst subsidies for DRT are not a statutory duty, there will be concerns regarding the continuity of funding, although another highlights that integration with other services can cross-subsidise provision. To attract users, increasing awareness of services and overcoming the barriers presented by the need to pre-book, either by removing this need or overcoming passenger concern, was highlighted by respondents. Other stakeholders, such as community transport and commercial operators including taxis, are

identified as having a growing role in the future. Technology is identified as playing a growing role in order to facilitate service differentiation and support more flexible booking.

The potential for DRT across Ireland

Results of the survey demonstrate that DRT is a policy tool capable of delivering benefit both socially and geographically, thus meeting policy goals of Northern Ireland and the Republic of Ireland [7,8]. By design it can be integrated with other public transport modes and serve key trip generators, many of the schemes reported on in the survey are designed as such and it is highlighted as a priority for future development. Whilst a limited number of services operate commercially, with only the most effective schemes requiring lower subsidy than those reported on in 2005 [9], in many instances investment in DRT is deemed to be justified with a number of pilot schemes continuing once central funding is no longer available. This is particularly true of rural areas where some respondents identified it as the most cost effective way of ensuring access to services. This is because DRT provides 'coverage efficiency', even if rural services can be the most expensive to provide. This highlights the potential for investment, or continued investment in rural provision across Ireland. Should funding be available, it is expected that DRT will continue but with a growing role for taxis, increasing 'deep rural' provision and greater local decision-making as to the level of flexibility. Northern Ireland is unusual given the role of Black Taxibuses in providing and maintaining an urban DRT service. In many cases competition between public transport forms and operators makes this untenable.

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