An introduction to Demand Responsive Transport as a Mobility Solution in an Ageing Society

An ActiveAge Research Paper

Demand Responsive Transport is a local transport service tailored to passenger needs, operating not unlike a taxi service. It is usually provided where there are infrequent bus services, such as rural areas.

The ActiveAge programme’s Mobility research strand is bringing together cutting edge transport and technology expertise from government, academia and the corporate sector to focus on the mobility needs of the elderly, and the development of appropriate products and services to support these. The three main areas identified for initial research and development:

- Assistive technology and intelligent transport systems
- ICT supporting the customized delivery of transport services
- Personal mobility aids for the elderly

When carrying out research into the second area – ICT supporting the customized delivery of transport - ActiveAge identified the significance of Demand Responsive Transport (DRT) and the potential for technology solutions to improve delivery.

This report introduces the subject of DRT, providing background as to the concept and how it has developed.

A further study will develop the role that technology can play in making DRT a more cost effective public service, and possibly in helping develop a commercially viable business model.

Introduction

For the elderly, transport and mobility form a vital link to friends and family, social and recreational activities. This is essential for maintaining an independent lifestyle. Limited mobility prevents older people from participating in social activities, and research shows this leads to depression and consequent health problems as a result of loneliness. As early as 1975 James Lynch wrote “The Medical Consequences of Loneliness” and identified loneliness as a cause of premature death.
A more recent report by Help the Aged highlighted the fact, more than one million people say they are often or always feel lonely, with 48% saying the television is their main form of company. One of the reasons for this is limited mobility and the difficulties older people encounter when using public transport.

Demand Responsive Transport (DRT) has been developed in response to a number of different mobility problems for people living in both rural and urban areas. It is known in its broadest form to be a more ‘flexible’ form of bus travel and matches its level of service to meet the particular needs of its customers. This can in some cases extend to other forms of transport but the bus is the most common form of DRT.

DRT is any kind of transport whose day-to-day service provision is determined by the demand of its users¹. The system can work in different ways but most commonly is carried out as follows: the customer rings up the booking service from their location and can be picked up at the same place as soon as availability allows. The bus, taxi etc. then takes them to wherever they want to go - in essence the system has made it possible to respond more directly to the mobility requirements of the individual passenger. In many cases this is not always the quickest or cheapest way to travel but it is often the most convenient for the type of passenger the scheme is aimed at - the elderly and people with mobility problems.

The bus or taxi is shared by a number of different passengers with similar requests within a given area or zone. This can often mean that journey times take longer than a direct point to point service. The system brings many benefits to the people it aids and can sometimes be indispensable for a person, whether it is for business or social occasions or just for their daily transport needs². Brian Masson, Projects Manager for Angus Transport Forum, states, “it is possible to design services that are more user receptive than those currently provided. However, this requires greater integration and coordination of services and the ability to identify demands both met and unmet”³ which is precisely what DRT constantly aims to achieve and provide for its users. Technology potentially offers opportunities to streamline and integrate some of the operational aspects.

As well as the potential for an improved passenger service DRT also makes it easier to serve a wider area with fewer vehicles. This can offer better service for around the same cost as conventional public transport and fills the gap between taxis and normal buses.

DRT schemes do require substantial financial support, but in the right area can be very successful, especially when passenger demand is dispersed. In such cases not every place in the defined zone has to be visited on every journey, thus cutting transportation times while giving customers more options when it comes to where they want to be dropped off etc…⁴

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¹ http://conferences.holyrood.com/content/view/612/142/
² http://www.drtbus.co.uk/new%20what%20is%20drt.htm
³ http://www.abdn.ac.uk/~wox004/release.php?id=1147
⁴ http://www.tess.org.uk/49index
**History of DRT**

Over the last decade DRT services have expanded and become more frequently used in many towns and cities, despite the fact that they are often criticised for a lack of flexibility in route planning and an inability to manage high demand. The increased demand for DRT services is the result of a number of reasons including: the shortcomings of conventional regular bus or taxi services in specific areas, where there is a growing need for better transport systems for the elderly or disabled and where there has been new developments in these ‘community transport’ systems.

DRT services have been in operation for as long - if not longer - than scheduled services in the UK. A good example is the Northern Ireland Black Taxibus that provided the service for Belfast and Londonderry during the late 1960s and early 70s. The dial-a-ride system was introduced about forty years ago in Milton Keynes. This system had many faults. Its main downfall being the limitations in dealing with the specialist groups it provided for, with disabled people making up the largest percentage of its customer base.

These limitations included, the flexibility of the route, time taken to get to destinations, pick up times and the availability of specific vehicles to match customer requirements. Operational and financial problems led to the failure of the service in Milton Keynes during the 1970s. “It did not take the corporation long to discover that it was promoting this innovation with one hand tied behind its back. In the end, confronted with rising costs the borough council declined to put additional funds into what it now regarded as a bottomless pit”.

One of the biggest advances, combined with improvement in the above problem areas, was in the area of communication and computing equipment. The fact that technology has become more powerful and less expensive has made dial-a-ride a feasible, albeit still an expensive form of public transport that will continue to benefit people with mobility problems in cities and remote communities. It is in this area of developing ICT solutions for the customised delivery of transport that ActiveAge believes there are gaps in the market and opportunities for further development.

**Why DRT?**

Despite car ownership increasing dramatically there is still an issue in the UK with regard to the mobility needs of disabled and elderly people. Thirty years of studies have proved that various societal and demographic changes have shaped this problem and due to the increase in the elderly population of the UK, there has been a distinct increase in reliance upon cars and public transport - forcing the problem into the 21st Century.

This issue of a “lack in affordable, accessible transportation services where personal mobility is an essential component of well-being” has existed for over 40 years and is essentially what DRT has set out to solve.

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5 [http://sciencedirect.com/science_ob=ArticleURL&_udi=B6VG8-496FRHV-4&_user=10&_rdoc=1](http://sciencedirect.com/science_ob=ArticleURL&_udi=B6VG8-496FRHV-4&_user=10&_rdoc=1)
8 [http://www.rural.gc.ca/researchreports/transport/no4_e.pdf](http://www.rural.gc.ca/researchreports/transport/no4_e.pdf)
DRT is not accessible to the whole of the general public but to a select few sections of the population that are unable to use or have difficulty in using standard buses.

When looking at the Scottish Government’s Economic strategy for DRT it is clear that they have positioned the system to contribute to mobility across the country and not just to target specific people. These contributions range from improving reliability and journey times, maximising opportunities for employment/disability/leisure and tourism, to connecting people and places through providing sustainable, integrated and cost effective public transport alternatives to the car. They also look at DRT from an environmental perspective. The Scottish Government can see the benefits that this system brings to the majority of the population- not just the elderly or disabled.

The main benefits that DRT brings⁹ to its users in communities around the UK:

- Flexibility in scale
- Services can be targeted to specific zones or areas
- Quick and easy to change or adjust operating times
- High frequency on-demand services
- Wider network coverage can be obtained with given resources
- Can help to serve the 7-20% of the population who are outside the Authority’s minimum distance and frequency criteria relating to their subsidised services.

From looking at the above benefits of DRT across the country and various communities, it’s understandable why there is a desire for such systems to be run throughout the UK. DRT addresses many problems in the country’s transport system and has become a reliable option to enhance independent living for many people who have no one to rely on for transportation when they need to get out of the house for necessities or to socialise.

**Problems/Difficulties for the elderly using public transport**

When people get older, using public transport becomes a more essential part of their everyday lives - as it plays a major role in keeping them mobile¹⁰.

This will lead to considerable pressures for our transport systems of the future and particularly on their resources, as our populations continue to age at a rapid rate.

The limiting effects of old age are known to be most prominent between the ages of 75-85, where getting up or sitting down can become increasingly difficult, as muscle strength starts to decrease and hearing or sight becomes weaker. Waiting times or route deviations are often an issue for the elderly, as they can be more susceptible to illnesses particularly in winter months and may not be able to walk distances.

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Buses and trains can be very difficult for people with mobility problems. If the bus is busy it can be very difficult to move around, especially if in a wheelchair, or when using a walking aid. This may offer a potential commercial opportunity. They could operate extra services privately, for an area where they feel there is a specific demand for extra transport, or adapt their own service vehicles to be more accessible and user-friendly for the elderly and disabled. At present, DRT is difficult to sustain as a solely privately operated system, as costs are too high to support a realistic commercial business model.

Public and private transport both present difficulties for the elderly and disabled. However, public transport has specific problems. It can often be very stressful for older people. For example, it takes longer to cross the road, get on the bus or train and walk to a seat. Ticket machines can be complicated with there being a lot of information to take in. The person may not have the knowledge of how to use such technologies. It is important to note that this may not be such a problem for future generations, as the Boomers will be more familiar with technology.

DRT schemes are designed to ease the above burdens and can be used for a range of activities, including shopping, visiting friends/family, attending local clubs, doctor and health centre appointments and hospital visits. It is easy to see how these services can become a central function in many people’s daily lives, especially if they have problems walking or getting out of the house.

Health problems are a major reason for people giving up driving and converting to public transport.

In particular, it is reported that vision problems seem to be the most common reason why people have to stop driving and find different ways to get around and still maintain a level of independence. So, there is a definite need for adequate transport alternatives that cater for the needs of people with these specific problems.

Ongoing research is being carried out by the Massachusetts Institute of Technology’s (MIT) AgeLab, developing “new ideas and technologies to improve the quality of life for older adults and those that care for them”. MIT are looking at driving in particular, with relation to the elderly and DRT systems. AgeLab focus on producing new research to expand the understanding of older drivers and help them deal with changes in their driving abilities. Professor Joe Coughlin of MIT, Founder of AgeLab, dedicates his time to researching transportation issues and its role in public health and safety.

MIT have found the majority of Baby Boomers in the West are auto-dependent and that bus usage decreases in people aged 60 and over in the

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United States. However in the UK, Netherlands, Canada and Norway the number increases.15

AgeLab experts have found different factors contribute to the reluctance of older people to use conventional public transport. These include, risks of slips or falls, emergency evacuation, anxiety of waiting at bus stops and handling fares, unfamiliarity of surroundings, technologies or the services themselves, and the ongoing fear of violence or threats (portrayed by the media) that appears to be a more regular occurrence in cities. AgeLab continues to be at the forefront of major projects and research into a range of ageing topics including transportation, housing, health, communications, work and retirement, services and decision making around aging and caregiving.16

Existing DRT schemes - Aberdeen area
In February 2008 Aberdeenshire Council launched two new A2B dial-a-bus services providing door-to-door transport in the Formartine area. This can be distinguished from the dial-a-bus service, which was run in the Aberdeen city area. A2B provides services in rural areas such as Fraserburgh and Oldmeldrum. This particular service commenced business on the 3rd March 2008 in the Aberdeenshire area. Currently there are eleven different A2B services running in the Aberdeenshire area covering Inverurie, Alford, Westhill, Central Buchan, Donside & Echt, Fraserburgh, Huntly, Oldmeldrum, Peterhead, Strathdon and Turriff.

Aberdeen city’s DRT pilot was the urban dial-a-ride with Stagecoach Bluebird operating the scheme.18 The pilot problems with the taxi call centre, and the bus operation was problematic due to ownership issues. There were control issues over the scheme itself between the bus company and the Government, who funded the system.

In addition, there were concerns over meeting future demand due to lack of vehicles These problems did however help with research into finding solutions about how to make DRT schemes more successful in the Aberdeen and Aberdeenshire area. As the pilot proved successful the dial-a-bus scheme received a new vehicle in November 2004 to help meet demand. The bus was provided by Nestrans and officially presented to the scheme at a special launch hosted by Aberdeen Football club.19

ComCabs in Aberdeen City provide a taxi-based DRT scheme that aims to meet the need of mobility challenged customers in London Using call centre technology that allows for the storing and accessing of customer information and their special requirements the drivers are able to respond to individual needs This scheme, although run by the company’s Aberdeen office, is based in London and uses the service successfully to meet the needs of the elderly and disabled in the city. See case study at www.activeage.org

16 http://web.mit.edu/agelab/projects.shtml
18 http://www.scotland.gov.uk/Publications/2006/05/18112606/4
19 http://www.aberdeencity.gov.uk/ACCI/web/site/CouncilNews/pr/txt_pr_dialabus_120607.asp?#content
Have these schemes been successful?

In general the DRT schemes have been a learning process for the customers and companies alike, as they both gained a great deal from the system. However, there are always ways to improve the scheme. Stagecoach outlined some key points to clarify how this can be done. The company’s ‘ingredients for success’:\(^\text{20}\):

- Small vehicles—with limited diversions for passengers from the most direct routes ensuring fast journey times
- High quality/high status image to persuade people that DRT is a viable and attractive alternative to car travel
- Door-to-door a high priority as the deterrence factor of walking and waiting at stops will be significant

In order to show how the public in Scotland perceive the existing DRT schemes, the Scottish Government carried out a survey on a selection of DRT pilot schemes.

Survey undertaken by the Scottish Government on DRT pilots

See APPENDIX 1

DRT facts and figures

Across the UK there is an overall patronage growth rate of 21% for the DRT schemes compared to figures posted in 2006. The rise in annual total number of passengers to the end of December in 2007 is 31% compared with December \(^\text{21}\) 2006. Greater Manchester figures show the extent to which the DRT schemes are being used - though it is to be noted in the second figure this was for a period of nine months only and the figures are continuing to rise:

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| Statistics from the 49Link DRT service in South Shropshire\(^\text{22}\) show that nearly 40% use the service at least once a week, while almost 25% use it more than twice. The main reasons for using the service for people was to do their shopping, gain access to healthcare facilities and to socialise. Many people taking part in the survey used the service for a combination of needs. It was found that 17% of people would not travel at all if this service wasn’t available. 81% said they were able to travel to wherever they wanted, whenever they needed and it was a flexible service with 85% agreeing that the system was very easy to use and helpful. These figures show the extent to which one community gets assistance from one service and proves how valued the system is by its users.

\(^\text{20}\) http://www.scotland.gov.uk/Publications/2006/05/18112606/3
\(^\text{22}\) http://www.tess.org.uk/research.html
Other DRT schemes – Scotland

The Local Authority Area Table shows that there are three main areas where there are DRT services in Scotland: 20 in the Highlands, 17 in Aberdeen, 10 in Argyll and Bute and only 2 in Glasgow City.

In Fife there are 8 schemes, one of these is the Council’s Ring and Ride (Levenmouth and Kirkaldy) service. This was originally set up in March 2003 to offer door-to-door accessible transport for people with reduced mobility in the surrounding areas. The scheme operates 6 vehicles and has attracted a large number of users. It currently undertakes 1000 passenger trips per week – 25% of these use the service for shopping and 50% for social visits. Funding for the scheme comes from the Council and will be up for review at the end of its three-year pilot. The Ring and Ride service has applied for extra funding to expand its area of operation but this has yet to be decided. The scheme has seen demand stretching resources.

Marketing was originally carried out through leaflets in the service areas but has not been expanded due to concerns over coping with the expected increase in demand. There has been very positive feedback from users who explain how the service has freed them from being housebound, with no alternative previously existing for travel. The social inclusion benefit of the service has also been assessed, not only the cost per passenger trip. The service has recently been given the go-ahead to expand Fife-wide over the next few years.

The Dial-a-Bus service in the SPT (Strathclyde Passenger Transport) areas around Glasgow is well established and is now carrying out approximately 340,000 trips per year, with a fleet of 34 wheelchair accessible buses.

The Ring and Ride scheme operates in the rural hinterlands of Glasgow and is expanding over time - the Lomond Ring’n’Ride service having a fleet of about 16 vehicles. The long-term aim of SPT is to cover all rural areas around Glasgow with DRT services where conventional buses cannot meet travel requirements.

Other DRT schemes – UK

Wiltshire has one of the most established DRT schemes in Britain called the ‘Wigglybus’. This was introduced to the UK in 1998 with funding from the Department of Environment, Transport and Regions. The scheme was so successful that there are now eight different routes that are operated by the ‘Wigglybus’, ‘Hopper’ and taxi-based DRT services. As a result of these schemes the county of Wiltshire is seen as a leader in the field of DRT.

In the Vale of White Horse District in Oxfordshire the Octabus Dial-a-Ride service is a door-to-door service for people who are unable, or find it difficult, to use public transport due to mobility problems. The drivers of the vehicles are trained in first aid, and how to help a wheelchair user or others with mobility problems.

23 http://www.scotland.gov.uk/Publications/2006/05/18112606/4
24 http://www.scotland.gov.uk/Publications/2006/05/18112606/11
25 http://www.scotland.gov.uk/Publications/2006/05/18112606/11
27 http://www.whitehorsedc.gov.uk/transport/assisted_travel_bus_passes/DetailPage-1270.asp
The Computer Cab TaxiCard scheme in the City of London has been around for over 20 years. This service is funded by the local authorities and run by Computer Cab, the Aberdeen based International Taxi Firm. (See Appendix for Case Study).

The Finnish model
The Scottish Government has been looking out with the UK for examples of best practice and specifically at Finland. The Finnish model includes the provision of two, day centres. These include a work centre for the disabled and a day centre for the elderly, which provides social opportunities for both groups on a daily basis. The service has run successfully since it began and is growing in popularity by the day, so it is clear why the Scottish Government are aspiring to this form of transport.

Funding DRT
Funding for the DRT schemes comes from three main sources:

- Government transport funding-national and local government discharging statutory duties to ensure that transport is available to meet all social and economic needs- including concessionary fares and Taxicards which leave the discretion with users about how and when they travel.
- Users- the fares or other funding contributions paid by passengers in line with their use of transport
- Purchasers acting on behalf of users- usually public bodies such as health or education authorities purchasing transport for students, patients, staff etc… but sometimes commercial companies purchasing services for staff, clients and visitors.

Source: Scottish Government Document

There is scope to develop a business model, which is a commercially viable opportunity for private DRT systems. Such a model might appeal to local businesses in smaller communities, in terms of economic benefits. A private company could offer a social element to their DRT scheme, as in the Finnish model. Thus, providing opportunities for older or less mobile individuals to socialize and not just address their transportation or mobility requirements. Adding a social element to DRT schemes would allow individuals to get out of the house to have fun with other group members. This could lead to an overall improvement in quality of life and provide something above what other UK DRT schemes currently provide.

Technology and DRT
Technological advances have meant it is now a lot easier and less expensive for community DRT schemes to have software incorporated to improve services. It is now possible to relay real time information over the Internet and WAP telephones into the home. This is mostly seen as a positive thing for DRT but there is a possibility that technology can lead to exclusion for older people who can’t afford the services and products or can’t use the

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28 http://www.scotland.gov.uk/Publications/2006/05/18112606/3
technology itself. However, as was mentioned above, this will become less of a problem with time, as the technology-aware boomers get older.

The Aberdeenshire pilot alone has incorporated five different DRT systems, which are all coordinated by a central TDC (Travel Dispatch Centre) based at Aberdeenshire Council, using Trapeze despatch software[^30]. This allows the schemes to operate on a real time basis through the use of in-vehicle technology. However, this is currently still in development and testing stages.

Ecolane DRT™ system[^31] is a technology that has been proven to take a company’s existing paratransit service to the next level of productivity and cost-efficiency. Paratransit services are the set of transportation services that fall between the single occupant automobile and fixed route transit. Examples of these are: taxis, carpools, vanpools, minibuses, jitneys, demand responsive bus services, and specialized bus services for the mobility impaired or transportation disadvantaged[^32].

The graph below shows the growth in usage of the ‘Mobisoft’ technology in DRT schemes in the UK[^33]. This technology is a scheduling and dispatching system that is used extensively to coordinate the vehicles of a specific scheme.

![Graph showing growth in Mobisoft technology](image)

Mobisoft has now worked with over 20 UK local authorities to provide systems for their public DRT Travel Dispatch Centres. Longest running is the West Sussex DoRiS service. From their bookings taken in July 2000, it was shown DoRiS handles around 8,000 trips per month. West Sussex is now building on the success of this call centre to introduce an integrated unit for all their transport provision including mainstream schools, SEN (Special Education Needs), and Social Services.[^34]

**Technology and DRT – future concepts**

European research is currently involved in finding solutions and improvements for public transport services, communication links and

[^30]: http://www.scotland.gov.uk/Publications/2006/05/18112606/9
[^31]: http://www.ecolane.com/services.drt/index.html
[^32]: http://www.fema.gov/oer/reference/glossary.shtm
[^34]: Source of content: Mobisoft.fi website
booking/dispatch software\textsuperscript{35}. These technologies aim to provide better, cheaper solutions for widespread applications of the software and encourage technological developments in the framework of a competitive open market place.

Smart Cards could be incorporated into DRT services in a number of ways. They could help with identification and localisation of customers, act as electronic tickets for trips and support electronic payment systems for fares. Registration of passengers for a specific DRT service - using smart cards - could also provide proof of transport performance and allow this to be continually monitored.

Research has already identified available technologies to assist DRT schemes, help prove the general feasibility of the general concepts help boost further developments towards cheaper, reliable and standardised equipment. This equipment ranges from cheap, powerful, data communication between vehicles and the control centre, to fully automated booking and dispatching systems. This also allows for precise forecasts of arrival times within a highly flexible DRT operation.

Essentially- “Existing technologies like the GPS localisation in GIS systems need to be better adapted to the specific needs of DRT operators.” -TRG online.

\textsuperscript{35} http://www.trg.soton.ac.uk/rosetta/workareas/1_pts/pts_pr1_concs.htm
APPENDIX 1: Survey Undertaken by the Scottish Government on DRT Pilots

Extract from Scottish Government Document to detail the findings of this survey:

Selected user surveys were undertaken on some of the pilot schemes to identify the features of the services which users appreciated or found difficult.

Key points identified were:

- **Flexibility and reducing advance booking times** - Some interesting differences between centralised and operator-run TDCs were highlighted from user interviews. Central Buchan Service taxi DRT trip requests are encouraged at least a week in advance, and generally no later than a day before travel, although some flexibility non this can be offered. This is partly due to a centralised TDC, with pick up timings fixed to enable an efficient routing/schedule to be developed for the vehicles. User/operator consultation has suggested that the less flexible the booking approach, the more users expect the vehicles to run exactly to the pre-determined time, and this is not always easy with variable conditions on the roads. Conversely, trip requests on the East Fife service are managed directly by the taxi firm, and as a result the service has the ability to be very flexible and meet requests for trips at very short notice. Scheduling is, therefore, very dynamic and the direct contact with the operator meant that users appeared to understand that the service has to be flexible, and were more tolerant to 'delays' or less precise pick up times.

- **Expectations** - On Aberdeenshire Council DRT services predominantly serving elderly people, the users had come to expect that services always served the same (e.g. shopping) locations and had not considered that the services could be used for other purposes and locations, and therefore always booked the same trips.

- **Ownership** - Having a non-local number for the call centre is considered by some to act as a barrier as users perceive remote TDCs a having a lack of local understanding. However others did not perceive remote TDCs to be a problem.

- **Threat** - Direct transfer from fixed route bus services to DRT provision (e.g. in Central Buchan) resulted in perceptions that the bus service 'was being taken away' despite a direct replacement, providing more flexible provision, being introduced. Aberdeenshire Council had to manage this negative feedback through enhanced publicity and direct user engagement.

These findings highlight the importance of the impact of user-provider interactions in DRT delivery, and the impact that booking procedures can have on user understanding and acceptance. Users may be slow to understand how to access DRT, or adjust to a situation where they can use a service to take them anywhere they want so this process of change needs to be managed.

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36 Full section from: [http://scotland.gov.uk/Publications/2006/05/18112606/](http://scotland.gov.uk/Publications/2006/05/18112606/)