

# DEMAND RESPONSIVE TRANSPORT

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Guidelines for Public Transport Service Providers

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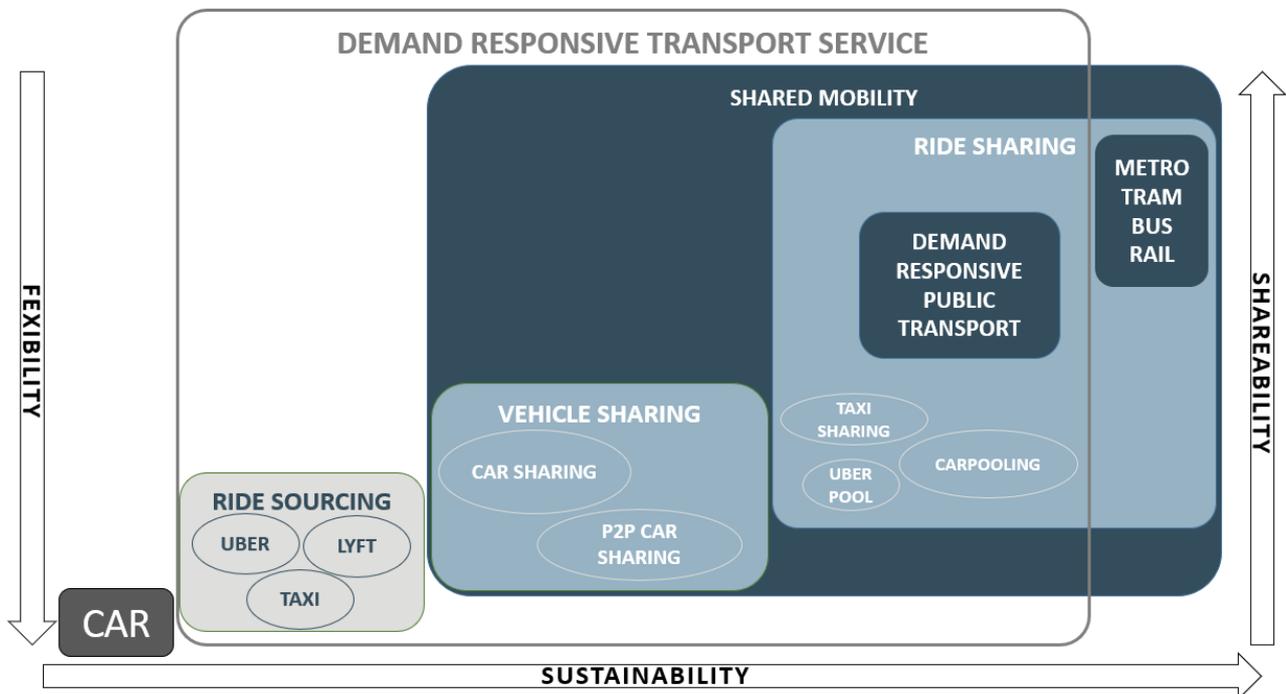


## What is Demand Responsive Transport?

Demand Responsive Transport (DRT) is a flexible form of public transport that adapts to the needs of its users. DRT does not follow a fixed timetable or route. Instead, the route or timetable is calculated in response to user requests - vehicles change their routes or timetables based on particular transport demand at the time.

DRT has characteristics of both buses and taxis and can take the form of a wide range of solutions: from the familiar "dial-a-ride" services that are usually booked by phone, to dynamic applications that allow trips to be booked through an application that adjusts the route in near real-time to accommodate new pick-up requests.

DRT services are well suited to be shared and flexible, using fleets of vehicles that are deployed on demand to pick up and drop off passengers according to their needs (1). DRT lies somewhere between the unsustainable, flexible and individual transport services provided by private vehicles (e.g. cars) and the sustainable, shared but less flexible traditional public transport services (metro, tram and bus), with varying degrees of sustainability/shareability/flexibility depending on the service (Figure 1).



**Figure 1: Classification of Demand Responsive Transport services (1)**

Recent developments in technology and business models have led to much greater diversity in the modes of transport available (2). In the past, the vast majority of trips in urban areas were made by private vehicles and public transport, with taxis, cycling and walking making up the rest. Fast-forward 10 years and there are now all sorts of transport options, including car sharing and ride sharing, as well as dockless bikes and electric scooters (eScooters). Notwithstanding these new offerings, there remains a significant gap in the market between relatively low-cost/subsidised public transport and walking/cycling and commercial rideshare and taxi services (2). There is growing interest in whether on-demand public transport can fill this gap.



DRT can be used to solve a range of mobility problems. It can be used for first and last mile service for passenger and freight transport, or it can replace poorly performing, low-frequency low patronage services by transferring users to the wider public transport network. On-demand public transport is particularly suitable when there is insufficient demand for frequent and direct mass transport.

### Benefits of Demand Responsive transport

- Replace a fixed route

Because a DRT service operates only when needed and on an optimised route, it can cover fewer kilometres overall than a fixed-route service, which reduces fuel consumption. Also, the size of the vehicles can be adjusted to the expected number of passengers, reducing CO2 emissions per passenger and per kilometre travelled. More trips can be made when a DRT service is aimed at unlocking suppressed travel demand to improve social inclusion and rural mobility.

- Substitute car journeys

A DRT service can replace multiple, single occupancy car journeys. For example, in a commuting area where there is insufficient demand for a fixed bus service, or to serve those who work in shifts or work flexibly. Switching from a private petrol or diesel car to a DRT vehicle would improve emission reduction.

- Encourage active travel

There is an opportunity to better link bus and DRT services with cycling and walking to make it easier to travel without a car and by different modes of transport. This can be facilitated by taking bicycles on board or on external racks, or by providing secure bicycle parking facilities at bus stops or frequent destinations.

### How Demand Responsive Transport works

Typically, Demand Responsive Transport works as follows:

- A passenger enters a date and time he/she requires a journey (which could be on the same day, a minimum time span for booking a required journey is defined, depending on nr. of vehicles and service area size, e.g. 30 min., in some examples a maximum time span for booking is defined as well, e.g. one week in advance).
- A local service runs its algorithms and suggests pickup times for the passenger.
- The passenger is given a time window for pickup.
- The passenger selects a time window and is confirmed on the journey.
- The route is modified and updated without interfering too much with the existing passengers on the route.
- The passenger receives updates about his/her trip and the location of the assigned vehicle.
- The passenger is picked up within allocated time window and taken to his/her destination while dropping off and picking up other passengers on the route along the way.



## Types of DRT

Demand Responsive Transport is implemented in many different ways. Its main characteristic is flexibility and demand responsiveness, being adaptive in either scheduling, routing or a combination of scheduling and routing. The most commonly used types of DRT are (2):

- **fixed routing** (itineraries) and **flexible scheduling** (fixed time slots or on demand);
- **fixed routing** (itineraries) with **routing deviation on demand**;
- with **flexible routing** (itineraries) with **predefined stops**;
- with **flexible routing** (itineraries) and **flexible stops** (door-to-door service, very similar to a taxi).

DRT services also differ in terms of the type of vehicles used. Depending on the market served, DRT services can be provided by minibuses or medium-sized vehicles (22 to 30 seats) that work well on semi-fixed route patterns. Sometimes cost-effective DRT services can be provided by taxi operators at specific times in areas where demand is low and more dispersed.

### Examples of Demand Responsive Services (2)

- A **“Virtual line”**. A virtual line is a service that is similar to normal scheduled services since it stops at fixed stopping points, follows regular routes and runs according to timetables set in advance. The basic difference compared with normal scheduled services is that it only runs if requested by one or more users.
- A **“Door-to-Door” service**. A Door-to-Door service, although less common, is a service transporting users from their homes to specified destinations. It is reserved for the elderly or for people with reduced mobility. There is no set route in this case and the service may be provided by taxis or minibuses belonging to the main network operator.
- **“Stop-to-stop” or “point-to-point” services**. Stop-to-stop or point-to-point refers to a system that serves an area with stops defined in advance. Routes may vary depending on stops and user demand. It may also use taxis or minibuses.

On-demand public transport is not the same as commercial ride-sharing services such as Uber, taxis and others (although there may be scenarios where ride-sharing providers could participate in on-demand public transport). Commercial on-demand services typically focus on optimising the journey for the individual passenger to reduce waiting and/or travel times. On-demand public transport focuses on optimising the journey for groups of passengers travelling to or from a hub at a subsidised price. This can result in relatively longer waiting and travel times compared to commercial on-demand services and is more likely to involve shared journeys.

### Good practice example: Demand Responsive Transport in Budapest



BKK Centre for Budapest Transport operates six DRT lines in the outskirts of Budapest. The telephone service booking was expanded into an online service request for the local DRT lines. During the 1-year pilot, 527 passengers registered, 60% of whom used the system regularly and frequently. As both users and the transport operator were satisfied, the online booking system will remain in operation. The booking system will be integrated into the BudapestGO app in the near future.



## Things to consider

DRT services are most effective when integrated into a regular network, and they are not the right solution in all circumstances. When planning a Demand Responsive Service, the concept is to develop and operate the service based on an interaction with the passenger before the routes, stops and time frames (service) are determined. When planning new Demand Responsive Transport services, the following steps should be taken (3):

- Analyse existing situation including legal framework.
- Obtain input from policymakers and the community.
- Design the service.
- Understand costs and funding.
- Get people on-board.

### Mobility challenges of the area (analysis of existing situation)

The mobility problems in the area are the main feature that needs to be understood when considering the introduction of DRT. This would help in deciding whether DRT is suitable for the area in question. The following points should be considered:

- the main areas to be served (residential areas, industrial areas, tourist areas),
- the identification of key destinations, such as employment zones, major employers, town centres, hospitals and health facilities, leisure attractions, transport hubs in the area,
- existing passenger transport services,
- existing mobility habits in the area.

Demographic and economic data must be taken into account as well as the reasons for which people travel (purpose of the trip). The matrix below shows the viability of flexible public transport services in peripheral areas, considering demographic and economic data as well as the purpose of the trip.

According to a report of the Transport Research Board of Transit Cooperative Research Program (4), the trip demands that are most suitable for Demand Responsive Transport services come primarily from the traditionally transport-dependent populations of elderly persons, people with disabilities and people on low incomes, although there are youth activities that could be considered. When populations are less transport-dependent or trip purposes are more time sensitive, the viability of DRT service diminishes.

| Demographic/Trip Purpose | Youth < 18                                    | Adult 18 - 64    | Elderly 65 and over                            | Persons with Disabilities | Low-Income Persons |
|--------------------------|---|------------------|--|---------------------------|--------------------|
| Work                     | Low Potential for Demand Responsive Transport |                  |  |                           |                    |
| School                   |   |                  |  |                           |                    |
| Non-Emergency Medical    | High Potential                                | Medium Potential | High Potential for Demand Responsive Transport |                           |                    |
| Shopping/Groceries       | Low Potential                                 |                  |  |                           |                    |
| Shopping/Other           | High Potential                                | Low Potential    |  |                           |                    |
| Social interaction       | High Potential                                | Low Potential    |  |                           |                    |

**Figure 2: Matrix of the DRT potentials bases on user's typology and travel reasons (4)**

The key to designing a DRT service is to target the service to the transport-dependent population and to use origins, routes and destinations whose trip purposes are not time-dependent.

Check out [SMACKER Review of policy level for rural and peripheral areas](#)





### Legal framework

Legislation should be studied carefully to comply with existing laws and regulations. DRT may be regulated in detail (vehicle size, operation areas, permits) or there may be no DRT-specific legislation at all, or it may be unclear. A good understanding of national legislation is necessary to ensure compliance with public transport regulations. Nevertheless several good practice examples show the legal basis for the implementation of a DRT in the European countries.

### Service design

DRT services should offer a degree of flexibility compared to traditional public transport. However, flexibility can vary widely, and many decisions need to be made to achieve the right definition and the most efficient organisation suitable for specific area.

Check out

SMACKER

[Review of service level and technical level for rural and peripheral areas](#)



#### DRT service area



The area to be served by DRT should be defined to enable optimal service operation. The optimal physical size of an area for a flexible public transport service depends on population demographics and density, topography, activity centres in the area and existing operational boundaries. Overall, the optimal area should be rather small to maximise customer needs, route flexibility and directness.

#### Routing and scheduling



A variety of different concepts are possible, ranging from a fully predefined route and timetable to a service where stops and transit times are fully defined in a period just before operation or even during operation. The choice of route and timetable should be organised to best serve the mobility needs in the region.

#### Booking technologies



A crucial element for DRT services are the booking options for rides - from telephone booking (important for older people) to booking via the internet and smartphone app to Hail-a-Ride (the customer stops the vehicle at the bus stop). The deadline for the booking (time of booking request before the desired ride) should also be considered. All of this has implications for the technology needed for operational planning. There is no rule on how to manage bookings, but usually simpler is better.

#### Vehicles



Smaller vehicles are almost always used in providing demand-responsive services since productivity and demand is limited. Factors to be considered in the selection of a vehicle type and size:

- passenger loads,
- ridership characteristics (commuters, tourists, passengers with disabilities, senior citizens, youth, etc.),
- route or zone distances,
- capital funding,
- costs,
- maintenance and storage capabilities,
- operating environment,
- driver requirements (licences for driving the vehicle).



## Costs and Funding

Current experience with DRT services shows that these services are mainly not sustainable without direct subsidy. Strong support from local authorities is needed to ensure viability and increase revenues. Contributions from local businesses or large employers may also be appropriate if the system serves a commercial area or touristic destinations that are not well served by public transport.

### Costs



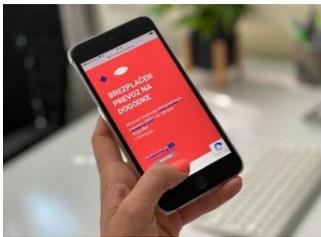
The main costs to be considered are driver costs (salaries), vehicle costs, fleet size, service standards (e.g. response times or journey times) and technology costs (booking, routing, etc.). The optimal balance is likely to be determined by the availability of funding and passenger expectations. It is unlikely that the DRT tariff would cover the cost of the service in any market.

### Funding



Most DRT services are currently subsidised by local transport authorities. If there are opportunities for subsidies and support, the mechanisms need to be clarified in time. If there are subsidies available in public transport, it is also very important to clarify if there are barriers that prevent DRT from being subsidised. This is very important because DRT often cannot be operated on fare revenues and some kind of support and subsidy is needed.

#### Good practice example: RESPONSIBUS - mobility between hotels and major event site



The DRT service connects hotels and the city centre with a major event area in a small rural region in Slovenia. It serves both residents and tourists and is offered as a free-of-charge transport option for event visitors to promote sustainable mobility and provide an alternative to mobility by car. A customized IT solution has been developed that allows booking of RESPONSIBUS rides via application in three languages.

## Getting people on-board

Attracting sufficient ridership is critical to the viability and success of a DRT service. Communication and continuous engagement are needed to increase understanding of any DRT service, encourage improvements and build confidence in the reliability and sustainability of the service. The more people know and understand about the service, the more familiar they are with it, the more likely they are to use it. Various nudging and promotional campaigns can be designed to reach different target groups of potential users. For instance, following campaigns can be considered:

- Guided (demand responsive) public transport tour per target group.
- Demand responsive public transport try-out activities (free public transport test ticket etc.).
- Competition with lottery to promote (demand responsive) public transport commuting from home to work/school.
- Personal mobility assistants for elderly people or persons with disabilities at major transport interchanges.
- Bonus mile programme for (demand responsive) public transport.
- Gamification for (demand responsive) public transport.
- Mobility management in workplaces and organisations.

Promotion of Demand Responsive Transport can be combined with promotion of public transport and sustainable mobility in general.

Check out  
[SMACKER](#)  
[Review of](#)  
[behaviour change](#)





Interested in developing Demand Responsive Transport?

SMACKER can support you all the way!

Use **SMACKER TOOLBOX** and access best practices, guidelines and templates to develop a DRT service.



### Project Partners



### References

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