



Demand-Responsive
Transport to ensure
accessibility, availability
and reliability of rural
public transport

WP 3.2: MAPPING STUDY OF INNOVATIVE DRT BUSINESS MODELS - SWEDEN

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1 General status of Demand Responsive Transport (DRT) in the country

1.1 General on DRT

In all regions of Sweden, public DRT is offered in various forms. The traffic is generally not well known amongst citizens as it is not marketed to the same extent as regular scheduled public transport. The rules for DRT differ widely between regions and sometimes within regions, between different municipalities, which makes it difficult to compare regulations and determine which is most efficient or respond the best to customer needs.

In Sweden, DRT must always be booked before the journey begins. The required time of booking ranges from one hour before the journey begins, for example in Halland up to the day before on Gotland. Prices and products, as well as payment systems and rules, differ between municipalities and regions. In some regions all ticket types are valid and DRT services have the same price as the regular public transport system. In other cases, only a single ticket that is paid in a separate system and/or with a different pricing structure is valid.

In some regions the travellers are picked up at their homes, in others, the DRT is based on several predefined pick-up locations. In other regions, the DRT follows a regular bus route and connects the stops that are along the line, while there are also regions with DRT available in a defined geographical area.

In some regions, demand-responsive traffic is interconnected with patient transport and special transport services, while in other regions, DRT is separate from these transports. Overall as has been seen in Sweden DRT services can take many different forms and come with as many different set of rules. With so many different rules and details, it is not surprising that it is difficult for the citizens to have knowledge of the DRT system.

1.2 Purpose of Demand responsive traffic

In Sweden DRT, is in most cases, a traffic form that is used where the population is sparse and scattered. In some regions, regular routes with low load factors are converted into DRT services as passenger numbers decrease. In other regions, alternative forms of DRT are developed to meet needs not only tailored to commuting. For example, there are services which contain only trips in the middle of the day on certain days of the week to tailor the need for reaching specific public services. Other examples include DRT being used to supplement the regular traffic in the evenings and on weekends. It is unusual that demand-responsive traffic is used for the purpose of daily commutes or at times when the public transport system has the largest demand and supply, i.e. morning and afternoon on weekdays.

Närtrafik (literal meaning "near-traffic") is a form of DRT that is found in many regions. It is an extended service used in rural areas to increase accessibility to public and private services. The Närtrafik acts as a feeder system direct to places with these services or it can feed to BRT lines and interchanges in public transport.

Demand responsive traffic can primarily be found in rural areas, but in Kalmar, for example, DRT is also used in urban areas.

There are still a few regions where coordination between DRT and regular traffic is done, but there is a development in this direction. Today, the systems are to a large extent parallelly planned and developed. To increase customer benefit, digital services are being developed for DRT services, and there is a goal of being able to search for information on DRT services and regular services in the same system.

1.3 Follow-up and evaluation

The DRT is not evaluated systematically as is the case for the regular traffic. In many cases, when it comes to usage and possible savings there often is a lack of statistics about the DRT. Evaluation of special transport services (STS) and patient transport (PT), which are two forms of DRT, is organized by Svensk Kollektivtrafik (Swedish Public Transport), which is an industry organization for public transport in Sweden. ANBARO is an ongoing quality survey of STS and PT, conducted annually since 2004. Travellers are interviewed by phone the day after their trip. They are asked about booking and reception, as well as their impressions of the trip. Interviews are conducted daily, year-round. In the ANBARO survey 2018, 20 out of 21 counties participate, giving a 95 per cent coverage.

2 Examples of demand-responsive transport services

Below are 2 examples of demand-responsive transport services that can be found in Sweden.

2.1 Case study No. 1 (Närtrafik)

Närtrafik is the name of the service that can be found in Region Västra Götaland. As a form Närtrafik can be found in many different areas in Sweden.

Table 1. Parameters of Närtrafik

NO	AREA	QUESTION	REPLY
1	Name	<i>What is the name of the DRT service?</i>	Närtrafik
2	Organization	<i>Organization responsible for the DRT service</i>	Närtrafik exists in all municipalities in Region Västra Götaland
3	Location	<i>Please describe briefly the area that the DRT service is covering. Rural/urban/mixed.</i>	Mainly rural area.
4	Population	<i>What is the population in the service area and how are they located?</i>	The service area is set up regarding the overall access to public transport. In areas with less than 10 daily scheduled trips by public transport, customers can use "Närtrafik".
5	Customers	<i>Please describe what customer group are you targeting, if any (Disabled/elderly/children etc.).</i>	Mostly elderly people and to some part younger (15-18 years).
6	Network topology	<i>Please describe your DRT network topology and what are the reasons behind it. (Fixed routes, door-to-door or fully flexible, partly flexible, combined with public transport)</i>	Routes are planned due to demand and possibility to combine several purposes of trips.
7	Frequency/ availability of service	<i>What is the DRT schedule, how frequently does the service run, i.e. only when requested, set number of journeys per day?</i>	Weekdays, Monday-Friday. Five slots during 09.30-22.00.
8	Notice requirements	<i>When is booking required (on the day/when required, in advance, repeating booking)?</i>	Booking is possible from 14 days up to 1 hour before the scheduled trip.
9	Pick-up location	<i>Where are users picked up and dropped off (many-to-many, one-to-one, one-to-many/many-to-one)?</i>	Pick up at customers home – drop off at several fixed bus stops in municipal centres or similar points of interest.
10	Transport type	<i>What types of transportation do you use (buses, cars, trams, trains)? Are vehicles also suitable for people with special needs?</i>	Mostly taxi vehicles (cars). In some cases vans.
11	Sharing a ride	<i>Please describe if passengers share a ride or get their own ride.</i>	Trips with DRT can be combined with other trips, for example, service to hospitals.
12	Fares	<i>Please give an overview of the ticket fares. Are there any discounts? Is it per kilometre or fixed price etc.? Do the customers pay it themselves or is it funded</i>	Fixed price per trip (same price as a single ticket in public transport, 44 SEK as of December 2019) Paid by card or cash.

		<i>by local government? Can they pay in cash or with a card?</i>	
13	Total cost	<i>What is the cost of providing the service? How much do you as a transport organizer pay for it? What is the share approximate/precise share of revenues from tickets?</i>	The net cost of each trip is approximate 220 SEK.
14	Ordering	<i>How do users book their journeys? Please describe the transport ordering process shortly and why you chose it to be like this. (App, web, phone call)</i>	Booking is made via telephone. There is an ambition to add other measures of booking. Eg. App.
15	Concept	<i>Is your DRT service together with regular public transport or separate? Why is it so?</i>	DRT is part of the public transport but tickets are not valid for transfer to public transport.
16	Start time (ending time)	<i>When did you start to provide this service, is it still on-going or not?</i>	Started 2004 as a trial in some municipalities. Since 2016 Närtrafik exists in all municipalities in Region Västra Götaland.
17	Improvements/ changes	<i>If you would change or improve some aspects of your transport service what would it be and why? Also, how would you improve or change it?</i>	Integration of DRT service and public transport – possible to transfer with the same ticket. Improvements to search and get information about the service since very few people know it exists.

2.1.1 Data barriers related to the Närtrafik service

Table 2. Identification of data barriers related to the DRT case study: Närtrafik

Nr	Question	Optional answers	REPLY
1	What are the most important KPIs for the evaluation of your organization related to the transportation of passengers?	Cost, accuracy, customer satisfaction,	1.Customer complaints 2.Customer satisfaction 3.Accuracy
2	Are you collecting data from the transportation of passengers?	What type of data are you collecting? 1. Pickup and drop-off points? 2. Number of passengers 3. Vehicle types 4. GPS data 5. Fuel consumption 6. Accuracy of pickup and delivery? 7. ...	1, 2 and 6 Ticket type
3	Are you using the data collected to monitor in real-time the transportation?	YES/NO (additional comments)	No, we don't have real-time monitoring. We interpret real-time monitoring as surveillance of vehicles position and speed.
4	Are you storing the data and using the historical data from analysis and optimization?	1)Please describe the currently existing data platform used for the planning and operation of special transport services (STS) and DRT. (Information flow, which type of GIS data is used, how is data updated, where is data stored, how is data retrieved). Is this data platform specific to 1 organization or is this country-wide? 2)Please describe the major challenges related to the currently available data platforms (cost, data availability, accuracy of data, etc.) 3)Please explain the pricing on the use of various proprietary software & data providers for the use of special transport services (STS) & DRT systems (app-s, maps, ticketing, etc.).	1) The platform for planning is PLANET sourced by the company PLANit. The information we have is pick-up and delivery address, geographic zones that permit booking of Närtrafik. Data is stored in a Geography database that is uniform for Västtrafik, one organization. Data is copied to PLANET from the geography database regularly. 2) Cost 3)The pricing is based on the number of trips.
5	Is there any information about the real-time monitoring of the	If possible prioritize the information that could benefit your organization the most 1)Would you like to know how the passengers evaluate the quality of the service you provide?	See above – Västtrafik does not have real-time monitoring. Västtrafik regularly evaluates 1, 2, 3 & 4.

	vehicles you are missing?	<p>2)Would you like to know how accurate you are at pickup and drop-off of passengers?</p> <p>3)Would you like to be able to compare the accuracy of your current service with the service last year?</p> <p>4)Would you like to be able to do green accounting? (how large is the CO₂ emissions from your entire organization, or per passenger kilometre)</p>	
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2.2 Case study No. 2 (Anropsstyrd trafik)

Anropsstyrd trafik is basically what DRT is called in Sweden. This case study looks at the situation from the perspective of Värmlandstrafik who serves the region of Värmland where there is no närtrafik as mentioned in the previous case.

Table 3. Parameters of Anropsstyrd trafik

NO.	AREA	QUESTION	REPLY
1	Name	<i>What is the name of the DRT service?</i>	Anropsstyrd trafik
2	Organization	<i>Organization responsible for the DRT service</i>	Värmlandstrafik
3	Location	<i>Please describe briefly the area that the DRT service is covering. Rural/urban/mixed.</i>	Mostly Regional (Rural), some in more urban areas such as Arvika and Hammarö
4	Population	<i>What is the population in the service area and how are they located?</i>	Services span across Värmland's different areas and therefore can be thought of reaching all of Värmland's 280 000 inhabitants.
5	Customers	<i>Please describe what customer group are you targeting if any (Disabled/elderly/children etc.).</i>	There is not a specific target group of customers. The idea is rather that when the consumer base and travelling frequency are too low a DRT service may be used to provide services while at the same time being able to cut costs. Therefore Anropsstyrd trafik is targeting all potential customers regardless of what group they may belong to.
6	Network topology	<i>Please describe your DRT network topology and what are the reasons behind it. (Fixed routes, door-to-door or fully flexible, partly flexible, combined with public transport)</i>	Värmlandstrafik operates DRT services on fixed routes. However, in practice many bus stops along the route might not have a booking which means the route will be optimised by the driver, driving straight from point a to point b.
7	Frequency/availability of service	<i>What is the DRT schedule, how frequently does the service run, i.e. only when requested, set number of journeys per day?</i>	The availability varies across different routes. Some act as complementary traffic for already established public transport routes, by following the same route. Thus providing a higher frequency at times when demand is low and cost savings if there are no bookings for the service. Some DRT services act as complementary traffic in such a sense that they offer access to public transport.
8	Notice requirements	<i>When is booking required (on the day/when required, in advance, repeating booking)?</i>	For regional routes 3 hours in advance and for more central areas pre-booking is required to be done 1 hour before. All this during office hours (m-f 7-19, sat 8-18, sun & pub. holidays 9-18). Bookings out with office hours are handled when the offices reopen. So technically a booking for a Sunday service at 11:00 would still need to be submitted before Saturday 18:00.
9	Pick-up location	<i>Where are users picked up and dropped off (many-to-many, one-to-one, one-to-many/many-to-one)?</i>	Customers are picked up at specific bus stops along a pre-planned route.

10	Transport type	<i>What types of transportation do you use (buses, cars, trams, trains)? Are vehicles also suitable for people with special needs?</i>	The vehicle used depends on passenger demand. Both taxi cars and regular buses of different sizes used. Some vehicles are accessible and if requested upon booking Värmlandstrafik does their best to provide an accessible vehicle.
11	Sharing a ride	<i>Please describe if passengers share a ride or get their own ride.</i>	The DRT is a shared service if more than one passenger books the service.
12	Fares	<i>Please give an overview of the ticket fares. Are there any discounts? Is it per kilometre or fixed price etc.? Do the customers pay it themselves or is it funded by local government? Can they pay in cash or with a card?</i>	Same prices as would have been if a customer were travelling the same trip on regular public transport. Payment can be done through a credit card or buying a single ticket in the app. Our monthly passes are also valid for travelling with DRT.
13	Total cost	<i>What is the cost of providing the service? How much do you as a transport organizer pay for it? What is the share approximate/precise share of revenues from tickets?</i>	Värmlandstrafik only pays for traffic that is actually booked and performed. This means that compared to having the same services as regular public transport, DRT cut costs. The share of the revenue from tickets in the whole public transport system is approximately 40%. There is no specific figure for the DRT service but it can be thought of as substantially lower as it is utilised un low demand routes.
14	Ordering	<i>How do users book their journeys? Please describe the transport ordering process shortly and why you chose it to be like this. (App, web, phone call)</i>	Journeys are predominantly booked by calling Värmlandstrafik call centre, however, the possibility to book online and through the Värmlandstrafik app does also exist.
15	Concept	<i>Is your DRT service together with regular public transport or separate? Why is it so?</i>	The DRT is a part of the whole public transporting offer. It is a part of the bigger system because it is utilised in a way to increase accessibility to public transport in areas with low passenger demands, through extra services or entire routes. It is also a manner of controlling costs by effectively spending taxpayers' money only when a trip is, in fact, going to happen.
16	Start time (ending time)	<i>When did you start to provide this service, is it still on-going or not?</i>	The provision of DRT services started at the beginning of the '00s. Services are ongoing however individual lines are looked over continuously and may change based on passenger demands and cost/benefit analysis.
17	Improvements/ changes	<i>If you would change or improve some aspects of your transport service what would it be and why? Also, how would you improve or change it?</i>	A future alternative to explore would be what is sometimes called Närtrafik. Närtrafik is an on-demand service that collects and drives passengers in a different way. The DRT would connect passengers, when the want arises, to the more streamlined and faster RPT.

2.2.1 Data barriers related to the Anropsstyrd trafik service

Table 4. Identification of data barriers related to the DRT case study: Anropsstyrd trafik

Nr	Question	Optional answers	REPLY
1	What are the most important KPIs for the evaluation of your organization related to the transportation of passengers?	Cost, accuracy, customer satisfaction,	Costs, Customer satisfaction and Accuracy.
2	Are you collection data from the transportation of passengers?	What type of data are you collecting? <ol style="list-style-type: none"> 1. Pickup and drop-off points? 2. Number of passengers 3. Vehicle types 4. GPS data 5. Fuel consumption 6. Accuracy of pickup and delivery? 7. ... 	Number of passengers Number of trips GPS-data
3	Are you using the data collected to monitor in real-time the transportation?	YES/NO (additional comments)	Yes
4	Are you storing the data and using the historical data from analysis and optimization?	1)Please describe the currently existing data platform used for the planning and operation of special transport services (STS) and DRT. (Information flow, which type of GIS data is used, how is data updated, where is data stored, how is data retrieved). Is this data platform specific to 1 organization or is this country-wide? 2)Please describe the major challenges related to the currently available data platforms (cost, data availability, accuracy of data, etc.) 3)Please explain the pricing on the use of various proprietary software & data providers for the use of special transport services (STS) & DRT systems (app-s, maps, ticketing, etc.).	
5	Is there any information about the real-time monitoring of the vehicles you are missing?	If possible prioritize the information that could benefit your organization the most <ol style="list-style-type: none"> 1)Would you like to know how the passengers evaluate the quality of the service you provide? 2)Would you like to know how accurate you are at pickup and drop-off of passengers? 3)Would you like to be able to compare the accuracy of your current service with the service last year? 	Yes to all

		4)Would you like to be able to do green accounting? (how large is the CO ₂ emissions from your entire organization, or per passenger kilometre)	
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3 Barriers in the country related to DRT services

3.1 Legal barriers in the country

Regular public transport is if passenger loads are sufficiently large, cost-efficient compared to demand-responsive traffic with smaller vehicles, which are often used for special transport services, patient transports and as certain school buses. By making public transport more accessible, coordinating journeys of various kinds, introducing feeder DRT and so on, the need for journeys with special vehicles can be reduced. Therefore, it has long been an ambition from a regional perspective to integrate different types of transport that require special permits with one another and to integrate them with the regularly scheduled public transport. The integration is made more difficult by the fact that different laws are governing the different types of traffic and that different authorities are only responsible for their part of the traffic.

The division of legislation into regular traffic, school transfers, special transport services and patient transports exists to meet different travel needs and to identify who is responsible for payment. The legislation does not say anything about the type of vehicle that needs to be used and does not prevent coordination.

The main obstacle to coordination is that different authorities are responsible for the traffic and its rules, which creates hurdles by introducing special solutions. The legislation does not prevent traffic from being coordinated, however, something that can hamper development is when municipalities and regions must agree on how to finance the traffic.

3.2 Competition between other transport solutions

In Sweden, the law of public transport dictates that any traffic that a private actor could make a profit on shall not be paid for by public funds and thus should not be procured by PTA's. This means that commercial actors will act first and public actors will aim to fill in the gaps with public funds thereafter. Therefore, the law ensures that competition does not arise regarding regular public transport. On the other hand, other transportation modes can act as competitors such as the taxi business. This is mostly the case in cities while the supply and usage in rural areas are quite sparse. Besides having little competition there are also examples of cooperation between public transport and private organisations with different models. One model is providing free travels within the capacity of existing services when there is an event such as a city-run. The deal is to provide free travel to participants of the race this gives the public transport some marketing benefits while the traffic around the event arena is also alleviated. The organisation organising the event also benefit by being able to provide free transport to the race for participants. A second model of cooperation is when a private organisation straight up pays for extra traffic in conjunction with their event. A further option would be a mixture of the two above where the companies partly finance extra traffic and where the PTA sees an opportunity to promote more travels.

Furthermore, there are also examples of operating regular traffic that is run conditioned on when a recurring event occurs, such as the local hockey team having a home game. This is because there is a large demand to get to the specific event location and an expectation amongst citizens that society should provide this mobility service. As an extension when other one-off events that might draw the attention of a lot of citizens is known to the traffic organisers, if possible, reinforcement busses will be used in the regular services to meet the increased demand at these events. All these services operate just as normal with the regular fees associated and fixed routes.

3.3 Procurement schemes and barriers related to this

There are different legislation in place regarding the procurement of special transport services and patient transports, which are regulated by LOU, and other forms of public transport, which is regulated by LUF. The procurement process results in traffic planning needing a long time and furthermore, the procurement is often appealed, which takes time and is resource intense work. Since it is often taxi companies that operate demand-responsive traffic in Sweden the legislation for taxis is significant for the companies that drive procured DRT. It was as recent as 2018, the Swedish parliament decided to introduce a new category of taxi traffic that does not need a taximeter. Instead, taxi vehicles must be connected to a booking centre for taxi traffic and have special equipment.

3.4 Data related barriers in the country

The data platform in Region Värmland goes by the name TRIPLEX 2. The system is developed and owned by Region Värmland solely and is part of the county's intellectual property rights. Information is channelled into the system through manual input as a consequence of incoming phone calls where people want to book their trips in the STS/DRT domain. More clients are currently added to the solution making it possible to do booking also in a self-service-kind of manner through web and mobile clients. The system is reliant upon spatial information (i.e. the county geography, address information, nature of road conditions etc.) and is therefore integrated with the Swedish National Database of Roads (NVDB) and 3rd-party routing libraries such as XtremeRoute and ETIS. The system also collects real-time-position-data from vehicles in service, gathering GPS position in WGS84, bearing, speed and direction. The main system resides on-prem at Region Värmland, but compute-intensive parts of the system are cloud-based residing in Microsoft Azure.

The major challenges over time-related to the currently available data platforms will be mostly financial. It is quite costly being the one and only maintainer of a software solution. The system today operates on internal formats regarding data structures, ideas on incorporating the SUTI-standard into the system are there, but nothing yet has been materialized. Data availability is OK and over time better, but the prevailing problem will be data quality and how to uphold it – especially in flows where the main input will be manual and not sensory/automatic.

Pricing in current system revolves around typical usage of external consultancy services (system developer capacity) expressed as the amount of money/provided hours (e.g. 120 EUR/h). 3rd party licenses are usually annually based or in some cases based on the amount of vehicles or transport orders running in the system over a fixed period of time.

Speaking on behalf of the sector, in general, there are many ways to express pricing, but the most common ones are based on a fee/period-model. Some suppliers base the licensing model on the number of trips completed over a year with annual revision. As of ticketing, which is really a very limited scope in the Wermlandian STS/DRT, the main system is under a monthly license model but emerging actors are providing ticketing as a service, providing services against a return based on the number of sold tickets. Maps or GIS data, in general, can be used in open-source-way (OpenStreetMap for instance) but more qualified services can be bought once-off or per-period through the Swedish Lantmäteriet or by 3rd party providers such as ESRI, HERE, Google or others.