

THE USE OF TAXIS FOR SPECIAL AND INTEGRATED PUBLIC TRANSPORT IN SWEDEN AND THE NETHERLANDS

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Abstract

The aging populations in the Western world have created an urgency to expand and improve Demand Responsive Transport (DRT) for accessible public transport. In Scandinavia 2-4% of the population is entitled to heavily subsidized Special Transport Services (STS).

In Sweden, about half of the taxi industry's revenues come from the public sector. In the city of Göteborg the STS Authority handled about 1.5 million trips in 2006 by procuring centrally coordinated transport services with 80 special vehicles and about 350 taxi cabs. A key to success is a dual procurement process where the Travel Dispatch Centre is either in-house or procured from one vendor and actual transport operations from several private operators using results from a unique National Quality Barometer.

Tax-subsidies for mobility services are also substantial in the Netherlands, ca. 60% of the revenues of the taxi industry come from contracts with municipalities, public transport authorities and health insurance companies. An innovative shared-ride taxi scheme called Regiotaxi has been implemented on a large scale over most of the country. It is open to the general public but coordinated with STS and other target groups such as medical transport.

In Sweden and Denmark authorities contract with local taxi companies to provide "Complementary Transport" in rural areas where demand is too small for scheduled bus services.

In the future STS and open shared taxi will increasingly be used as feeder services to fully accessible mainstream public transport systems. There is thus a need to develop and bench-mark even more sophisticated information and scheduling systems and new accessible maxi-taxi vehicles. A modernized taxi industry will be a most important actor in such an integrated transport system. This paper presents the Swedish and Dutch models and gives special insight into how the public sector can control quality in the procurement of mobility services.

Content

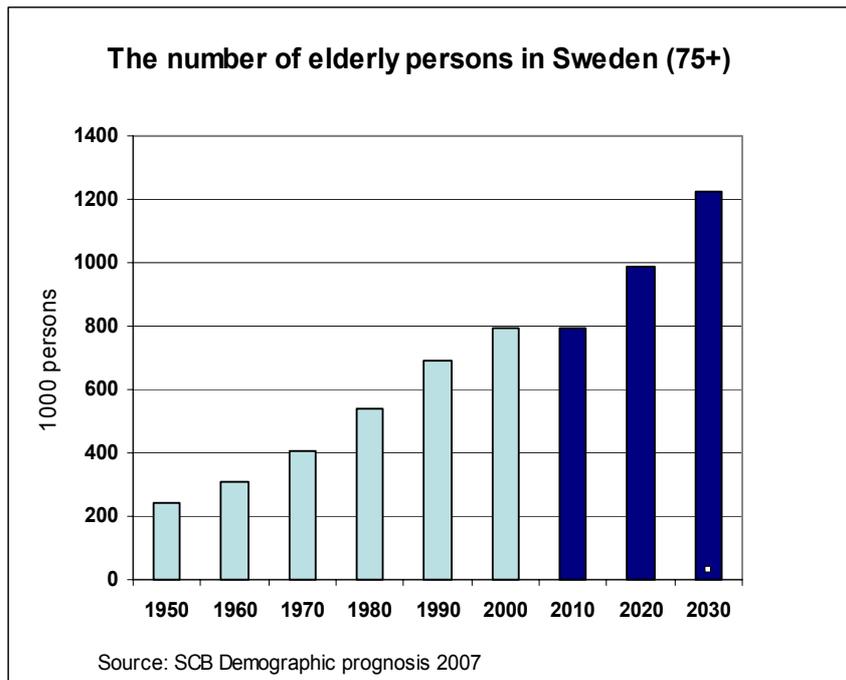
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INTRODUCTION

Aging populations require extended mobility services

The aging population is a common concern in most parts of the Western world as well as in Japan. In Sweden the number of elderly (75+) will almost double between 1990 and 2030.



Closely linked to aging are both functional impairments and cognitive problems that lead to generally reduced mobility. A study by the Department of Transport in the UK in 2001 shows that 14 % of the adult population (16+) has a physical disability or health problem that makes it difficult to walk or use regular public transport (1). In the age group 80+ about 2/3 have mobility difficulty. Systematic accessibility planning was therefore proposed by the Social Exclusion Unit of the UK government in a report 2003 (2).

Mobility services for elderly and disabled persons are an important social tool in a modern society. The main objectives are to provide medical travel, leisure travel (visiting friends etc), travel for shopping and errands and for younger users also travel to work and studies. There has long been a recognition in some countries of the Cross Sector Benefits of such mobility services, but this remains a hypothesis (3). To prove it would require long term panel studies of relevant samples from sites with large differences in service levels. In the meantime, decision takers accept paying substantial tax subsidies as a “preventive measure”.

For example, in Göteborg, Sweden, the tax subsidy for mobility services comprises about 4 % of the total municipal spending for care of the elderly and disabled persons. This corresponds to ca €50 per capita, a figure that is considerably higher than in other countries.

Such concerns have created an urgency to expand and improve taxi services for special and integrated public transport. This is particularly true in the Nordic countries, in the Netherlands and UK but also in other parts of Europe and in the USA, as will be discussed in other papers of this conference.

In Scandinavia 2-4 % of the population is entitled to Special Transport Services (STS).

Taxis are an important element of such services and even though usage has declined somewhat during the past few years, about half of the taxi industry's revenues in Sweden still come from the public sector. It seems, however, as though the authorities' use of taxis is still in its infancy in most other European countries. The reason for this may partly be concern over how to control the quality of services, an issue that will be discussed in this paper.

The degree of liberalisation of the taxi industry could be another factor, but perhaps not a decisive one. The use taxis for public transport seems to function as well in the regulated Denmark as in the deregulated Sweden.

DRT – an immature business sector - finally on the move

Mobility services are often designed as Demand Responsive Transport (DRT) systems with door-to-door, shared-ride service on demand. Technically traditional taxi can also be seen as a form of DRT, but in this paper we follow international practice of only including shared-ride taxi (not groups). In the US, DRT actually means Demand Responsive Transit (transit = public transport).

DRT dates back to early American experiences with Dial-a-Ride, a form of “paratransit” in the late 1960s, to bridge the the “gap” in service between cars/taxis and public transport (4). Most systems were bus- or van-based but many also used shared taxi. Even if most of these systems were open (to the general public) initially, they soon focused on special needs, especially after the introduction of Americans with Disabilities Act (ADA) in 1990.

Similarly, DRT in Northern Europe from 1970s and onward was basically a matter of special needs transport. Significant large scale open and integrated shared ride taxi has only been seen from about 2000, which will be discussed in the context of the Dutch Model below.

It is remarkable that DRT after more than 30 years is still a very fragmented and immature business. There is still a lack of common standards, interfaces, vehicle specifications etc. Even the terminology is still very shaky at best. With the greater focus on DRT that is expected in the coming decade it is urgent to further develop international collaboration to deal with these issues. Perhaps the new International Transport Forum could provide a platform for such work (5). UITP is another possibility, but they still seem focussed on mainstream public transport. Even so, some of their members (e.g. Storstockholms Lokaltrafik) are spending over 17 % of their total tax

subsidy for public transport on DRT services, a segment which provides less than 1 % of their total trips.

Some recent efforts to expand the scope of taxi services

In the mid 90s an extensive feasibility study was conducted in the Gold Coast region in Australia (6). It used an elaborate simulation model, LITRES-2, to analyze the scope and consequences of an open and integrated DRT called Personal Public Transport. One of the main architects of this system, Glazebrook, has eloquently described the need to bridge the gap in service between conventional taxis and regular public transport. He argues that the big volume in the Australian hotel business is not in the youth hostels or the five-star Hiltons but in the middle segments. What if we only had a choice between Trabants and Cadillacs? However there is still no large scale DRT in Australia so far....

Based on Glazebrook's argumentation, Westerlund tried to introduce DIXI – Differentiated and Integrated TaXI services in Sweden in the late 90s (7). DIXI was differentiated in price and service level and integrated by taking various user groups in the same vehicle. So far this has not been successful here either. In Sweden DRT is still mostly used for traditional special needs transport, and to a lesser extent for rural minimum service for the general public. As reported in a recent global survey of DRT this is still also the case in most other countries (8).

However, as we will show below, changes in the legislation in Netherlands during the late 1990s and some innovative thinking have resulted in the almost nation wide implementation of Regiotaxi. It is open to the general public but coordinated with STS and some other target groups such as medical transport. By widening the scope, the possibility for coordinating trips increases, and thus also the economic viability. For special needs users the fare is normally set about equal to regular public transport, while the general public pays 30-50 % of a corresponding trip with an exclusive taxi. RegioTaxi is true large scale DRT in the sense that some sites provide more than 1 million DRT trips per year. A similar service called VestTur has been implemented on Sjaelland in Denmark, albeit on a much smaller scale.

Another interesting development, also on much smaller scale, is the Nacht-AST in Linz, Austria, which has existed since 1987 and carried some 100 000 passengers in 2003.

This system may soon be reproduced on a larger scale with the introduction of shared Night Taxis in Brussels, an important case study in the “capital of Europe”.

THE SWEDISH MODEL

History and legal framework

In 1975 the Swedish government enacted state funding for municipalities (35% of operating costs) to organise Special Transport Service (STS) for disabled persons. This led to a rather fast proliferation of such services. According to the Social Law of 1982 it became a legal requirement for municipalities and in the 1990s 5 % of the population was eligible for STS. However the law was rather vague regarding scope and service levels.

In 1997 a law was enacted which states that STS is no longer a social welfare issue but a matter of transport policy to provide adequate transport service to persons with disability who have considerable difficulty using the regular public transport system.

STS is still a municipal responsibility but local authorities are encouraged to hand it over to the regional Public Transport Authority (PTA) in order to improve coordination with other travel services and agencies. The law also encourages cost savings by increasing use of more accessible mainstream public transport. There is no state funding for STS.

The strong legal backing has caused the formation of some very large DRT service providers. A global survey in 2004 showed that Stockholm was largest in the world in terms of passenger volume, with about 4 million trips per year (7). The City of Göteborg and the surrounding PTA (Västtrafik) had each about 1.5 million trips. If combined into one agency it would pass metropolitan areas such as New York, Los Angeles and Birmingham (UK), which all provided about 2 million trips.

The Swedish taxi business was deregulated in 1990. The liberalisation of the taxi market meant easy access for new taxi companies that no longer needed to belong to a dispatch center. There was no longer a requirement to maintain a certain presence in defined areas but instead some requirements were added for standards of vehicles and drivers. With the addition of many new small taxi companies, there was initially a deterioration of service in general. However this does not seem to have any substantial impact on the STS market since normally only well-organised taxi companies are successful in the procurement of such services.

In the large cities the increased supply has led to a better functioning market for the procurement process. In smaller towns and rural areas competition may still be as poor as before liberalisation (9).

Färdtjänsten (FareService) in the City of Göteborg

Of the various DRT service providers in Sweden, the one in Göteborg is often hailed as being an early implementor and establishing “best practices”. We will therefore describe FareService of Göteborg in some detail, as an example of the Swedish model.

Göteborg is the second largest city in Sweden with about half a million inhabitants.

FareService is a municipal authority, set up directly under the City Council and with its own political board. Over the years FareService has increased its scope to also include STS for two adjacent municipalities and to operate those medical trips for the Regional Health Authority that run inside the city borders (up to July 2007).

The total staff is about 110 persons of who most work in the in-house Travel Dispatch Centre (TDC), open for booking by phone from 6.00 to 23.00 during workdays and 9.00 to 23.00 on Sundays and holidays. Trip booking can also be done via Internet at any time.

The average week-day load is some 4 000 calls.

Special Transport Service – an excellent door-to-door shared ride service

Eligibility for STS is granted to persons living in the city, who “because of a permanent disability have substantial difficulty travelling with regular public transport”.

In 2006 there were 21 400 STS permits, a figure that is well below the peak during the late 1990s, before the introduction of low floor vehicles in the mainstream public transport system, and the introduction of flexible minibuss services as described below.

STS is a door-to-door, shared ride service, where passengers are often required to travel with other people in the same vehicle. Two kinds of vehicles are used for STS, taxi cars of various sizes (<8 passengers) and retrofitted vans that are equipped to handle wheel-chairs.

Advanced Booking, Planning and Dispatch using the PLANET system

Since 1992 FareService has used a sophisticated IT support system (PLANET), originally developed in the Volvo group (10, 11). It calculates the best routes and makes optimum assignments of vehicles from the available fleet. Selection is based on lowest generalized cost, considering factors such as proximity to actual caller, vehicle operating cost according to driving times and bid unit price in the contract, special needs of customers and even quality rating for the companies. A trip can be booked in near real time i.e. 15 min before desired pick up. In contrast to many other similar systems, PLANET manages a fully automated dispatch where manual intervention is only necessary for trouble shooting. It also calculates the relevant pay to contractors, based on driving times and other factors, and perhaps most importantly a fair share of costs for payers (end-users and sponsoring agencies). Dispatching and traffic management can be done directly from the central TDC-computer or via the taxi companies' own dispatch systems through an open interface, normally preferred by larger contractors.

Another feature of the PLANET system is to always guarantee the taxi driver a certain dead-heading reimbursement to get back to base. If possible, however, the system always tries to link the various tasks so as to avoid dead-heading as much as possible.

Flexlinjen - an innovative complement to STS

To reduce costs for STS and also provide excellent service to those senior citizens who are not eligible for STS the City also manages Flexlinjen (Flexbus). This new form of flexible transport was introduced in a European demonstration project (SAMPO) in 1996 and later made a permanent part of the public transport supply (12). By the end of 2007 there will be 30 fully accessible minibuses (10-12 seats), providing local mobility service in 16 districts, thus covering most of the city.

There are typically some 100 fixed meeting points (simplified bus-stops) within a defined service area. Buses stop only at the meeting points where passengers have booked to be picked up or left off. The typical flex trip is only 2-4 km long and the service is available week-days 09-17. For longer trips and for other hours eligible persons still have to use the STS service. Users of Flexlinjen pay the same fee as for regular public transport, while STS users pay twice as much for a one-way trip by taxi. When a person with an STS permit calls for a taxi, the system will check if there is a flexbus available in the actual area and if the trip can be accommodated within the next hour in that mode. If that is not possible the request will be handled as any other STS booking and assigned to a special vehicle or a shared taxi.

The productivity is on average ca 5 passengers/vehicle hour. All passengers that can be reached by telephone receive automated call-back by the planning computer 15 min before the preliminary pick-up time. This is to confirm the given time or to notify about any planned delays (max 30 min). This innovative feature was introduced in order to fill the vehicles better but is also much appreciated by users. Geographic analysis is used for planning. Priority for service areas is based on elderly density and the elderly's accessibility (walking distance) to mainstream public transport (13).

The transport procurement model is a key to success

FareService does not operate any vehicles of its own. Transport services are procured from private operators in a manner which is compatible with the Swedish interpretation of the European Directive for Public Procurement. For the day-to-day operations the following vehicle resources are used:

- 200 taxis in max hour from a fleet of 350 contracted taxis from five companies
- 80 special vehicles with wheelchair lifts or ramps
- 30 low-floor minibuses for Flexlinjen

This is considered to be an efficient mix of fixed vehicles with full day contracts and spot-market hire of available taxis from contracted fleets. The PLANET system will always attempt to fill the fixed vehicles (since they are paid for anyway) and then, when necessary, or more economical, it will call for the use of a properly located taxi on the spot market.

FareService has its unique procurement model for the STS operations:

- A unit price (€ per vehicle hour) is given at the bidding moment (e g every two years) and then used each time when assigning a suitable vehicle for the actual transport task (together with other parameters). Contract periods can be relatively short and there is limited disruption when changeovers are made.
- A guaranteed minimum availability in the contract. Drivers are not allowed to refuse trips without good cause.

- A minimum quality level is required to be retained in the bidding process regardless of bid price. But quality rating it is also used for bonus pay and in Göteborg even as a small factor in the optimization algorithm to select a vehicle for the task.
- Environment is the most recent factor in the model. Low-emission cars are given a certain priority in the algorithm.

The National Quality Barometer is an important tool

The Swedish Public Transport Association (SLTF) is conducting a nation wide quality analysis for regular public transport since 2001. In 2004 this was extended to special public transport. A total of 11 000 interviews regarding STS and 9 000 medical trips were made in 2006 on behalf of a dozen service providers. Participation in the program is voluntary.

Sampling is made from the trip database in affiliated dispatch centers and customers are called on phone for a personal interview the day after the sampled trip. Besides interesting comparisons and self analysis for the participating agencies the results can also be used to establish quality index for transport suppliers. The passengers are asked what (taxi) company was used for the trip, how the service was overall, driver courtesy etc.

<u>Factor</u>	<u>Satisfied users</u>	
	<u>12 sites in Sweden</u>	Göteborg
Overall trip rating	93%	91%
Waiting for TDC (to book the trip)	86%	80%
Courtesy of TDC operator	94%	94%
Courtesy of driver	95%	92%
Driving characteristics	96%	92%
Finding destination	96%	93%
Vehicle accessibility/design	91%	83%

Example of results from the National Quality Barometer 2006 (N=11 000 STS users). Source: SLTF

As we can see in the above table, 93 % of all the respondents rated the overall trip as Good or Very Good on a five step scale (14). This rating is remarkably high compared to other government services and the corresponding rating for users of mainstream public transport in Sweden was only 70 % in 2006. Other details in the survey reveal that punctuality is very good in the STS shared taxi service; 93 % of users said that the vehicle was less than 10 min late for pick-

up and 95 % said that they arrived in time. Only 12 % of the respondents were wheelchair users: the rest had other kinds of mobility impairments.

Major taxi operators in Gothenburg

- **Taxi Göteborg**, an 85 year old taxi association with a common dispatch centre for ca 420 vehicles. Invested in a computer dispatch system already in 1980. Has been the major supplier for STS in the last 30 years but lost out in the 2006 procurement due to a technicality.

Their bid was challenged by a competitor that won in court. In 2006 the public sector (STS, school and medical trips) was 20 % of the turnover and in the end of 2007 this is expected to have fallen to 15 %. This loss has been compensated for by business travel in the current economic expansion.

- **Taxi Kurir**, the big winner in the 2006 procurement when Taxi Göteborg was ousted.

The company claims to have the largest total taxi fleet in Scandinavia, operating in 30 cities or towns. In 2006 the company had 240 vehicles in the city and about 30 % of the revenue from the public sector. At the end of 2007 this figure could well be about 50 %.

- **Taxi 020** is a newcomer in Göteborg with 110 cars and currently about 70 % of the revenue from the public sector. However in Stockholm, where Taxi 020 is the second largest with a fleet of 1100, they claim to operate with a more “ideal mix”, 1/3 of revenue from each of the major segments, public sector, private citizens and business.

The city also has contracts with a handful of other smaller taxi operators. Generally there is a bridge (open interface) between the PLANET system and the system of each operator. Traffic control, e.g. handling of disruptions, late arrivals etc is normally handled by the taxi company in cooperation with the Customer Service Department of FareService.

Taxis are used for demand responsive complementary rural transport

For two decades most municipalities in Sweden have contracted with local taxi companies to maintain some minimum public transport service in rural areas where volumes are too small to support regular bus lines. Typically a person living in the outskirts has the right to call for a service trip to the nearest town two times a week, e.g. between 10 and 12 on Tuesdays and Thursdays. The fare for such a taxi trip is then equal to a normal bus fare for a similar trip (if there had been one). The municipality picks up the difference in cost. Since the service level is low, the usage is quite affordable to the municipalities. In some regions PTAs have developed

similar concepts with several “travel opportunities” per day and with full coordination of these open trips with special needs transport (15).

Further developments

In Sweden there is now a focus on “mainstreaming”, i.e. upgrading various elements of the regular public transport system to make it fully accessible by 2010, a goal that may not be fully achieved. This effort is supplemented by the introduction of intermediate services in many cities. Where possible DRT and mainstream services will be integrated with a seamless feeder mode, at least for longer trips (16). Efforts are underway to upgrade integrated IT support systems with respect to information, booking, ticketing and actual trip surveillance, to make sure there are no problems along the way.

THE DUTCH MODEL

History and legal framework

In the Netherlands the development of major DRT systems for disabled persons started in 1994, based on a new law concerning transport for the disabled. Municipalities became responsible for the transport of the disabled in their community, just as in Sweden. They were advised to do this by implementing DRT services instead of direct user subsidies.

For financial reasons, setting up a transport system was also more attractive for the municipalities, than continuing financial support to the disabled.

In 1997 DRT in the Netherlands was again boosted by new legislation. It became possible for the regional PTAs to consider DRT a part of their public transport system. This implied that they could spend subsidies, received from the national government, on DRT development and operation.

Since 2001 the legislation has been set in the context of the Law on passenger transport, which distinguishes DRT (without timetable) and PT (with timetable) as two parts of the public transport system. In 2006 the old Law on services for the disabled was replaced by the Law on social support. This law strives for inclusion in a broad sense and aims also at integrating accessible regular public transport and other transport systems like DRT. A major effect of this law will be a greater push for the disabled to use scheduled services, such as bus, tram and metro, and to reduce the use of DRT shared taxi.

Organisational model for Dutch transport systems

National Government

- **Law on social support (Wmo)**
- **Law on public transport (WP2000)**
- **Funding for municipalities and other organisations for special needs transport, ca € 950 million/year**
- **Public transport funding for the regions (ca 20 provinces and WGR+regions) approximately €1 billion/year**

Provinces and Regions

- **Regional policy on transportation**
- **Contracting transport operators for both DRT (Regiotaxi) and scheduled services (tram, bus, metro, train)**
- **Approximately 70 PT-concession area's**
- **Approximately 60 DRT contracts**

Municipalities

- **Responsible for transportation for the disabled**

(Source: 17, 18)

The Dutch taxi industry

As in Sweden, also in the Netherlands the taxi industry is deregulated. The total number of taxi companies is ca 5 000, with 45 000 employees and 25 500 vehicles (51% mini-buses and wheelchair vans and 49% sedan cars for up to 4 passengers). The yearly turnover is € 1.1 billion. In the big cities the typical one driver – one car company is dominant. Outside the cities there are more mid-size and larger taxi companies (with more than 20 cars). The largest taxi company is ConneXXion Taxi Services (CTS) with 3 600 vehicles, operating in the whole country from a base of 30 locations. All DRT services are coordinated from one TDC. The yearly turnover of CTS is € 174 million, which implies a market share of ca 16%.

Only 28% of the Dutch taxi-industry turnover in 2005 was generated from on demand street-taxi. 72% was contract based, mainly from contracts with municipalities, public transport authorities, health insurance companies or healthcare institutes. An estimated 60% of the yearly turnover is based on services with public subsidies (19, 20, 21).

The Regiotaxi development nation wide

In the late 1990s many regions in the Netherlands, municipalities and PTAs worked together to develop and implement open and integrated DRT systems, most often called ‘Regiotaxi’. After public tendering a private transport company operates both the TDC and the actual transport operations with vehicles and drivers, sometimes in cooperation with sub-contractors. The result is that a great part of the Netherlands is covered by Regiotaxi, normally open to the general public. These systems share many identical components and characteristics. However, none of the systems is completely equal to another. The idea of a national availability and usage of DRT is stimulated by promoting a set of uniform characteristics, the name ‘Regiotaxi’ for all DRT and a national logo, to be used in brochures, at transfer points etc. (22). For the taxi industry Regiotaxi generates 23% of the yearly turnover (€ 251 million).

National Regiotaxi logo



Typical vehicle for Regiotaxi

The main characteristics of the Regiotaxi operations are:

- Demand responsive shared taxi, door-to-door (d2d);
- Users book their trips at least 60 or 30 minutes before the requested departure time;
- A time window of +/- 10 or 15 minutes around the requested time;
- Detours are allowed due to ridesharing, can be maximized as a parameter;
- Open to the public but mainly used by elderly and disabled people;
- Fares: for disabled equal to PT, for others ca. 3-4 times the normal PT-fare;
- Average subsidy rate is 50-70 %, equal to normal PT
- Focus on rural areas.

The Dutch procurement model

DRT systems are tendered by municipalities or public transport authorities. The public bodies usually keep some distance to the development of the transport system. Operators are considered to be transport specialists that can best develop (the details of) the transport system and that also have the greatest expertise in aspects like planning, TDC, vehicles and so on. The result of this is that the municipality or PTA formulates a set of demands and then procures the complete transport system in one procedure. After signing the contract, all activities to implement the system have to be done by the selected operator.

When problems occur during the implementation of the system or during the operation, the public bodies have no or limited knowledge of what can be done to reduce the problems, since most of the knowledge is retained in the transport company. Most contracts have a term of 3-5 years, and after this period the contract is tendered again. Problems occur, when the existing operator is replaced by a different one; all knowledge that is built up during the preceding period is lost and it most often takes the new operator a long time to bring back the system again to a reasonable quality level.

Planning and dispatching

Since there are many Regiotaxi contracts and many operators involved, the planning and dispatching of these systems are organised in different ways. Only in a few cases are planning and dispatching completely automated. Dependent of the size of the Regiotaxi system there is an automated pre-planning of trips to distinguished regions and/or sub-contractors. In most cases the booked trips are dispatched manually to the selected vehicle. All relevant data, starting with the booking of the trip and finishing with setting off the passenger and closing the trip, are stored electronically. Communication between vehicles and the TDC is done by Mobitex, GPRS, UMTS or LRN (23).

Assessing quality

The quality of the service is an important issue, especially the 'service level' which is the percentage of trips carried out in time. Usually a service level of 95% is considered to be feasible and acceptable. Planning and dispatching trips in a short period before the requested departure times is very challenging. Due to unpredictable changes in demand, the outcome of the planning process is also in many cases the weak point in the Dutch DRT systems. Delays for passengers can be more than one hour, despite extensive IT support in the dispatch centers and in the vehicles. Especially when DRT is used as a feeder service for fixed lines, the quality of the planning is a critical success factor. In contrast to the Swedish situation there exists no nation wide quality barometer (as there is in the Netherlands for fixed line public transport). The public bodies use different tools to assess the quality of their systems, such as:

- Analyses of the transport database;
- Customer satisfaction surveys
- Audits in the TDC;
- Group discussions with the customers;
- Mystery guest trips.

These means of research give good insight in the quality of the system. However, since they are set up locally, results and figures cannot easily be compared. A well functioning bench mark system would be helpful to assess what quality levels can be reached.

Den Haag case study

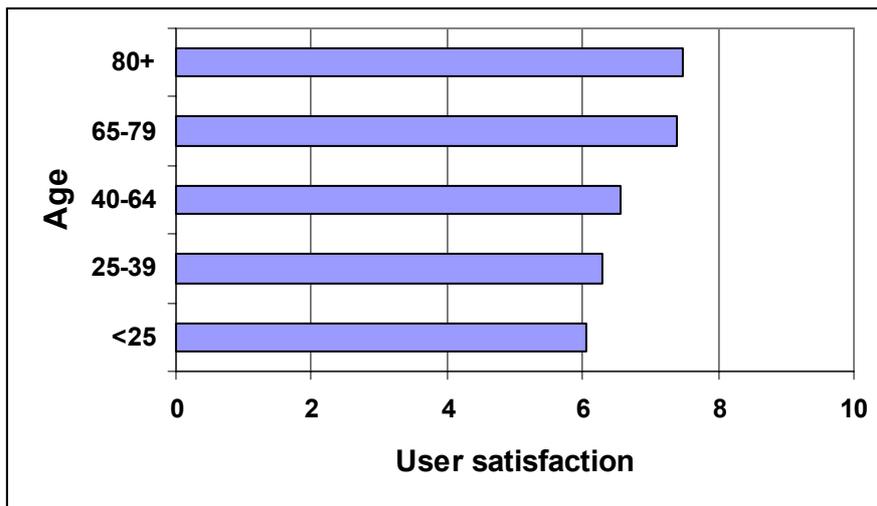
The region of Haaglanden consists of the city of the Hague and eight surrounding municipalities, including Delft and Zoetermeer as largest towns. The region has 980 000 inhabitants of which about half live in the city of the Hague, about equal to Göteborg in Sweden. Here exist two main DRT systems. The first one is Taxibus, the d2d shared taxi system for the disabled (STS) in the city of The Hague. The second one is Regiotaxi Haaglanden, open to everyone, but is also used mainly by elderly and disabled persons.

	Inhabitants	STS-permits	% permits	Trips/year	Trips/permit
Haag, NL					
Taxibus Den Haag	460 000	11 142	2.4	415 000	37
Regiotaxi Haaglanden	980 000			390 000	
Total				805 000	
Göteborg, SE					
STS Göteborg	485 000	21 500	4.4	700 000	33
Medical trips				280 000	
Flexlinjen				200 000	
Special school etc				220 000	
Total				1 400 000	

Data for Taxibus and Regiotaxi in the Haag Region and comparison with FareService, Göteborg, 2005

Customer satisfaction for RegioTaxi Haaglanden

In 2004 a survey was done among users of Regiotaxi Haaglanden. The average customer satisfaction for this service was 7.3 on a 10-point scale. This is slightly higher than tram and bus that scored a 7.0. The result shows that there is a strong relation between the age of a user and his satisfaction, see the figure below.



Relation between customer satisfaction and age. Regiotaxi Haaglanden 2004.

Taking a closer look at customer satisfaction, it is clear that the users are most dissatisfied with the time aspects of trips, especially with the punctuality of departure and arrival. The survey also showed that especially this aspect is most important for the respondents.

There are no comparable figures for other public transport modes, since quality in tram and bus in Haaglanden is only assessed on a 10-point scale (24, 25, 26, 27).

The comparison with Göteborg seems to indicate that the Swedish model provides a higher quality, but at this time we do not know the cost and efficiency implications thereof.

More extensive bench-marking efforts are highly desirable.

<i>Factor</i>	<i>Satisfied users¹</i>	
	<i>Haaglanden 2004</i>	<i>Göteborg 2006</i>
Waiting for TDC (to book the trip)	77 %	80%
Courtesy of the TDC operator	80 %	94%
Courtesy of the driver	84 %	92%
Driving characteristics	84 %	92%
Finding destination	77 %	93%
Vehicle accessibility/design	80 %	83%
Pick-up in time	57 %	n.a.
Arriving in time	58 %	95%
Connection to train or bus	42 %	n.a.

Results from a survey of customer satisfaction in Haaglanden, 2004 and comparison with results from the Quality Barometer survey in Göteborg 2006.

Further developments

After the proliferation of DRT in the Netherlands that took place mainly until 2003, a consolidation stage has started. The greatest attention is now on how to obtain a better price / quality relation for existing DRT systems. There are tendencies to adapt Swedish solutions with intermediate services like service buses and flexlines, in addition to the Dutch DRT model. The new law on social support (Wmo) makes necessary a more integrated approach between DRT and fixed line public transport, and also here “main-streaming” is an important part of the transport policy.

FUTURE DESIGN REQUIREMENTS

The need for purpose built clean and accessible taxi vehicles

Recent developments in flexible and integrated public transport have increased the demand for accessible vehicles of different sizes. Ordinary passenger cars and vans are problematic for wheelchair users as well as for other mobility impaired persons, e.g. those with rollators (walkers). For higher efficiency, vehicles should be so flexible that they can be used by as many categories of users as possible: i.e. true multipurpose vehicles. The design should also be attractive to all users (28).



Accessibility is often provided by wheelchair lifts due to the high floor of conventional minibuses and vans

¹ Very satisfied or satisfied on a 5 step scale (excluding neutral, dissatisfied, very dissatisfied)

ECMT and the International Road Union (IRU) recently released a joint report on accessible taxis (29), presenting the results of a study where many stakeholders have been represented. It outlines a set of requirements for two basic types of taxis (with and without wheelchair accessibility) and recommends that individual country governments adopt them at their own pace. In general the results are a broad compromise between an “ideal vehicle” as was presented by Oxley and Stahl in the European “Taxis for All” project in 2001 (30) and the more pragmatic approach taken by the taxi industry as represented by IRU and a handful of vehicle manufacturers.



Exterior and interior of the Taxi-for-All prototype, developed with co-funding from EU. (30)

One issue that still needs to be addressed is the lack of low-floor solutions for taxi vehicles. The EU Bus Directive stipulates a maximum floor height of 25 cm for city buses, while the ECMT/IRU study would agree to a maximum of 46 cm for the wheelchair accessible taxi, even if it recommended 20 cm. Another issue is the need for sufficient interior space, both for handling of wheelchairs and to give these taxis more of a “public transport feel” when users are sharing a vehicle with strangers. Both of these requirements point to the need for purpose built vehicles that make up at least some 20-30 % of the entire taxi fleet in major cities.

The requirement for purpose built cabs is further stressed by the current emphasis on ecological vehicles to combat climate change. New York City has required that by 2012 all of the 12 000 taxi cabs in the city shall be hybrid vehicles. This could be problematic because of the apparent lack of suitably designed hybrid vehicles for this purpose. The Toyota Prius is generally too small and the hybrid jeeps are hardly optimal taxi cabs. A purpose-built, low weight body, combined with a hybrid drive-chain and other relevant components from “oversized” SUVs might be an ideal combination for a new city cab.

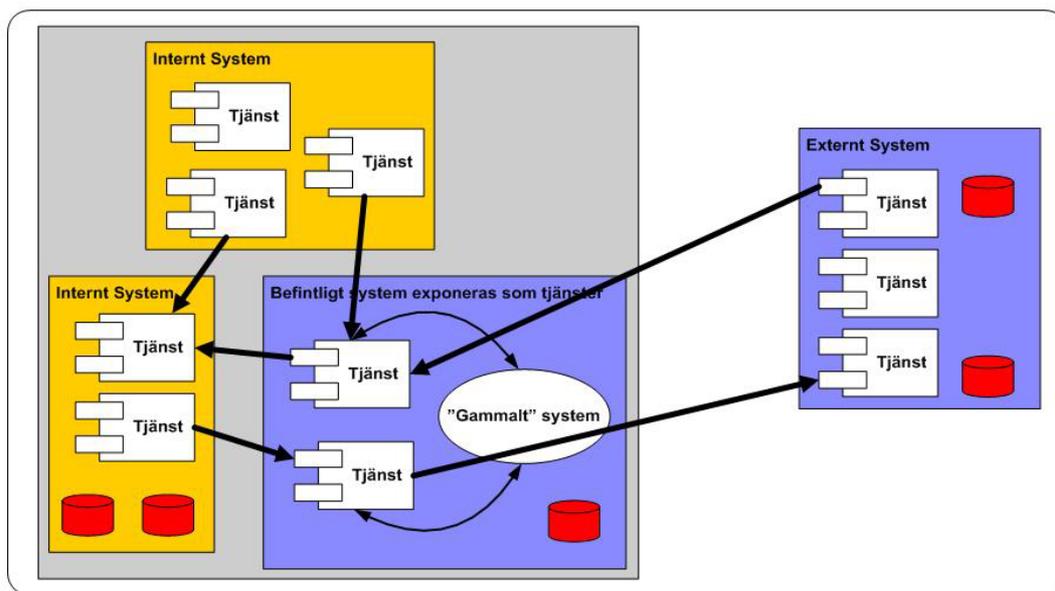
In conclusion the international community needs to form a user requirement group with representatives from major influential cities all over the world and to interact, perhaps in a large development consortium, with a few major vehicle and component manufactures.

The design and development of a couple of prototypes could possibly be done as an EU project with 50 % cost sharing.

Efficient use of the vehicles requires smart technology

While the Swedish and Dutch experience seems to suggest that the major technical solutions already exist, we have also concluded that the DRT business is still in an immature stage.

Thus there is also a need for international collaboration to develop proper terminology and specifications, particularly for the interface between different modules and components in the rather complex booking, planning and dispatch systems that are required.



Principle for Service Oriented Architecture (SOA) to interface different modules of a system.

Source (31).

One particular need of DRT, as compared to conventional taxi systems, is to predict driving times in order to maintain the linked assignments. With current congestion problems in many large cities this has been an increasingly difficult task. New technology with probe vehicles that report

real-time speed and position to a central database seems to be a reasonable approach to obtain more accurate driving times.

Another important standardisation task is to specify in detail the communication links between a central dispatch where the major coordination is done and the dispatch systems of the individual taxi companies that are performing the transport. In Sweden progress has been made in the standardisation of communication between dispatch centers and vehicles.

With future advanced feeder services such interaction may also need to include the passengers' mobile phone or other device.

CONCLUSION

- Efficient use of resources is obtained by contracting a substantial share (40-60 %) of mobility services in Sweden with taxi companies for vehicles on the "spot market" and the rest as dedicated vehicles for longer periods.

- A dual procurement process is normally used in Sweden, which first deals with the booking and planning services (TDC) and then, clearly separated (also in time), the actual transport operations. This fosters a competitive market by retaining several taxi companies at each DRT site. Successful operators are then awarded transport tasks (linked trips) according to bid price, available cars, dead-heading and some other factors. A general one-step contracting (as used in the Netherlands) often results in major disruptions and quality problems when a new contractor takes over.

- Soft issues like quality are difficult to evaluate and procurements often end up in the courts: this also happens in Sweden. However the possibility during the last years to use "hard data" from the Quality Barometer will lessen such problems. It is also an important tool to guarantee a minimum quality level and can be used for quality bonus or in the optimization algorithm. In many other countries authorities are reluctant to contract with taxi companies since they perceive that it is not possible to maintain an acceptable service level.

- Intermediate mobility services (with minibuses) in Sweden provide complementary accessibility with high service level at a reasonable cost to taxpayers. Digital geographic analysis is an excellent method for finding the "best" opportunities for various modes.

- The large scale implementation of open and integrated DRT services in most parts of the Netherlands is a unique deployment of innovative thinking in the PT sector, a new paradigm for special public transport, which also benefits other user groups.

- A brief comparison of quality indicators suggest that the quality of service provided in the Swedish model is significantly higher than is experienced in the Netherlands. Unfortunately there are no related figures for the costs and efficiency indicators. Further bench-marking efforts are necessary in a bilateral (or European) project.

- There is generally an important scope for international cooperation in order to make DRT a more mature business and to develop common terminology, standards and specifications. This is the case both for IT support systems and vehicles, as well as with respect to evaluation of different transport solutions and operating strategies.

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