SIKA Report

2006:1

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A case study within the project
The value of alternative transport systems

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Swedish Institute for Transport and Communications Analysis

About SIKA

Swedish Institute for Transport and Communications Analysis, SIKA, is an agency working in the transport and communications sector. Our main tasks are to make analyses, descriptions of the current situation and other reports for the Government, to develop forecast and planning methods and to be responsible for the official statistics.

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Background

SIKA has carried out a case study on a "general transport system" as part of a project concerning the planning of the Swedish transport infrastructure. The overarching question in this project is: *How can the planning process be organised to enable us to assess the value of alternative transport systems?*

One identified weakness with the present planning model is its deficient capacity to detect radically different transport solutions and to assess whether they are superior to the established solutions or not. This question is clarified by three case studies:

a) Can long-term sustainable car transport be developed?
b) Can advanced cycle traffic planning, in comparison with the present planning, tangibly change the distribution of choice of means of transport for short journeys?
c) Can a general transport system be developed which, taken as a whole, is superior to the established transport systems as regards generality, safety, travel time, accessibility, the environment, energy and cost?

The case studies are not intended to be alternatives – it is rather the case that they may all be bits of the puzzle in a future, perhaps quite different transport perspective. In particular, it is to shed light on how and why alternative transport systems encounter difficulties in implementation. The subjects for the case studies have been selected on the basis of reasoning about which puzzle bits can provide valuable contributions to answering the question.

This case study applies to point c) above. The report is based, among other things, on a consultancy report from Transek, Logistikcentrum and Swedetrack, *GTS – Generellt Transportsystem*, which has been published separately on SIKA's website (only in Swedish).

When the three studies have been carried out, SIKA is making an attempt to answer the question of how the planning process can be organised to give alternative approaches and systems in the transport sector a chance of being correctly assessed from the point of view of social efficiency. The question is accordingly not answered exhaustively in this report – it only serves as an illustrative example for the summary analysis.

The report has been written by Rickard Wall and Kjell Dahlström. Valuable contributions to the final content and form of the report have been made by Per-Ove Hesselborn, Göran Friberg, Marika Engström and Henrik Swahn (consultant).

A general transport system

In the past 10–15 years, great efforts have been made to introduce land-based above-ground passenger transport in a number of Swedish cities. Many preliminary studies have been made, in particular by individual municipalities. In general the focus has been on the small-scale variant called Personal Rapid Transit (PRT). This work has regularly been discontinued when the considerable initial costs of the systems have become apparent. Two circumstances are striking:

- In the social efficiency assessment, consideration is not always taken to the value of the land area saved that results from the implementation of a PRT compared with a ground-level transport system.

- The costs can be large when customised systems are to be built. Costs could probably be reduced if orders of PRT systems were to be co-ordinated, and it was possible to introduce batch production.

According to SIKA's preliminary assessment, it is probably not possible to overcome these two obstacles to the introduction of a PRT in Sweden without the government participating and taking additional responsibility for the issue. SIKA considers that PRT is a sufficiently interesting transport solution that a study should be made as to whether it is justified that the state becomes more involved than it has been to date.

What is a general transport system?

A general transport system – GTS – is a name for something that can be described as a vision of what our combined transport systems be like in the future. The vision need not mean that other transport systems will be replaced by GTS but rather that these may be gradually complemented by or become a GTS. We envisage that GTS has manifest advantages compared with existing transport systems as regards generality, safety, travel time, accessibility, the environment, energy and cost. However, we know little today about what a future GTS could entail, on the large and the small scale.

A prerequisite for a development of our transport system along the lines of the above sketch becoming a reality is probably that a GTS has manifest advantages in relation to the current structure of the transport system. This reasoning can be illustrated in the following table, where benefits and disadvantages with the present transport systems are indicated by plus or minus signs and with 0 where there can be considered to be lack of clarity or ambiguity.

Advantages and disadvantages of different transport systems.

	Generality	*Safety*	*Travel time*	*Accessibility*	*The environment*	*Energy*	*Cost*	*Goods*
Road transport	+	-	0/-	+	-	-	-	+
Rail transport	-	+	0/+	-	+	+	-	+/-
Sea transport	-	+	-	-	+	+	-	+/-
Air transport	-	+	+	-	-	-	-	+/-

Explanation: + = benefit, - = disadvantage, 0 = unclear, 0/+, 0/-, +/- = unclear, benefit or disadvantage depending on perspective

The signs in the table shall thus be regarded as a sketch where every individual sign can be discussed. The table is only intended as an attempt to provide a rough overview of the strengths and weaknesses of road transport, rail transport, sea and air transport which transport systems have today. If a completely new transport system such as GTS were to be introduced, it must reasonably have substantially all the various positive features desired, but which are thus not concentrated in any of the current established transport systems. However, it is conceivable to include a fifth row in the table for GTS where practically all signs would be set at plus. In one respect, GTS cannot be considered as superior to road, rail and sea transport in a very long perspective, namely transport of heavy and bulky goods.

At present, we thus know very little about the possible shape of a future GTS and what it might entail. The following picture provides an idea of a system where the vehicle can be driven on the road in a similar way to cars today but also connected to trains, retract its wheels like today's aircraft and be transported hanging under a girder several metres above the ground. It is not shown in the picture but it is conceivable that the system could also be adapted for sea transport.

GTS – a number of transport systems concentrated in one.
Illustration: Hans Kylberg, Visulogik AB

However, we know that already today various types of system for above-ground land-based passenger transport are being developed.

At present, there are no land-based above-ground transport systems in Sweden. Is this because systems of this kind are not justified from the point of social efficiency or are they unsuitable for Sweden for other reasons? Does it depend on factors such as alternative transport solutions are not given sufficient scope in the Swedish planning process? SIKA is approaching this issue in three steps:

1. A review of the existing situation as regards above-ground land-based transport systems, PRT and GTS, in Sweden and abroad.
2. An assessment of the scope it is justified to give systems of this kind in the Swedish planning process.
3. An assessment of the scope these systems are actually given in the Swedish planning process.

In relevant cases, SIKA will also make an analysis to explain why the justified and actual extent differ and make proposals on how the Swedish planning process can be made more balanced in this respect. This work will, however, largely be reported on in a future report from SIKA.

Existing and planned above-ground land-based transport systems

New means of transport have continually been developed to meet the need for transport – from sailing ships to steam trains to jet planes, electric high speed trains and mass car transport on motorways and in tunnels. In particular in the past 10-15 years, we have been able to see how *above-ground* land-based transport systems have become increasingly common internationally, in particular in Asia and the United States.

Schwebebahn in Wuppertal, Germany, constructed in 1901 and still in operation in 2006.
Source: Wikimedia

A great benefit of this kind of transport solutions is that they do not compete for increasingly scarce street space in the cities to the same extent as the corresponding ground-level systems would do. The systems have become increasingly technically advanced. The tracks are still local but they are becoming increasingly long. Already now, there are relatively far advanced plans to link cities together, for instance, in the United States and in the region around the Persian Gulf.

This development is not at present as clear in Europe as it is in other parts of the world. However, in Sweden interest in alternative transport systems has increased in recent years. Sweden is a country with a small population. The type of large systems that we see in cities such as Tokyo and Shanghai are probably not

suitable for Swedish conditions, which are more suitable to PRT systems. The technical solutions for such systems vary. A common denominator, however, is that systems are based on small driver-less vehicles. These are envisaged as running at frequent intervals and the system therefore has the same high capacity as modern tram lines.

Personal Rapid Transit and general transport systems – summary of the consultation report

SIKA sees a need for new transport solutions in densely-populated urban environments – to start with, but at a later stage perhaps also outside of these – which reduce traffic congestion and emissions, while at the same time making possible safe, comfortable and efficient travel. SIKA considers that PRT could be a transport alternative of this kind and the agency therefore regards it as important that more in-depth knowledge is obtained about PRT (and GTS).

SIKA has therefore commissioned a consultant group consisting of Transek AB (co-ordinator), Logistikcentrum AB and Swedetrack AB to produce a report which compiles relevant up-to-date knowledge about PRT from a number of aspects, and develops a technical discussion about GTS. The consultants are responsible themselves for the content of the report *GTS – Generellt Transport-system [GTS- General Transport Systems, in Swedish]*.

The consultants start their report by formulating the features that a PRT system should have to be of interest in Swedish conditions – high accessibility, high safety, environmentally friendly and with good fuel economy among other things. They also outline proposals for how introduction could take place – among other things, a start should be made by constructing short local systems which are gradually extended and eventually linked together into large networks.

The consultants then move on to discuss the design. There are a number of the technical issues that must be investigated: Should the vehicles run on girders or be suspended below them? Should the vehicles go on tracks or on their own wheels? Should it be possible to connect the vehicles together on the track and how would that take place in that case? And so on. The consultancy group presents the questions but does not take a position in this type of “detail reasoning” with the exception of certain recommendations, for instance, they draw attention to the advantage of the linear engine for operating PRT vehicles.

Considerable space is given to the effects of PRT in the consultancy report. The base material is studies made for a number of existing, planned and envisaged systems in Sweden and abroad. Among other things, they present estimated savings in journey times – which can be considerable – and the changes in shares for public transport – PRT increases the public transport’s share of the transport market. The consultants also present calculations showing the socio-economic benefit of introducing PRT. According to a cost model presented in the consultancy report, PRT can offer transport at a lower cost than most other means of public transport – for instance, bus and suburban train – for a broad interval of journey numbers.

Computer-generated picture of an envisaged PRT system in central Stockholm.
Illustration: Hans Kylberg, Visulogik AB

The prerequisites for introducing PRT and GTS

The last chapter presents results from estimates for a couple of systems in the United States, which also show the socio-economic benefit. SIKA has not carried out its own assessment of the socio-economic estimates and therefore refrains from taking a position on them at the present stage. However, the difficulties are underlined of making socio-economic estimates for a type of transport system which is not in operation anywhere in the world apart from in test facilities.

An examination of a number of preliminary studies of PRT systems has been made – in particular during the 1990s – in different municipalities in Sweden showing that work has been regularly discontinued when it has become apparent how large the initial costs associated with introduction of these systems could be. SIKA's preliminary assessment is that it may be justified for the government to take increased responsibility for the PRT issue in Sweden. The organisational issue should be examined. Perhaps the establishment of an intermodal transport agency could be a solution? An agency of this kind would among other things be able to work for standardisation and batch production of PRT systems, and in this way reduce the costs. If the existing agency structure is retained, perhaps a modified planning process for the Swedish infrastructure could be appropriate in this connection?

Why are these alternative transport systems not given scope in the Swedish process for infrastructure planning? Some working hypotheses on why there may

be obstacles in the way for introduction of alternative transport systems have emerged:

- The initial, and often substantial, costs can be a deterrent for enthusiasm in particular if they are to be fully borne by a particular municipality.

- There are no natural representatives for alternative transport systems in Sweden today – and hardly any co-ordinating actor which takes a holistic approach without prior conditions for the country's total community and transport planning.

- The value of the ground space saved that arises on implementation of above-ground transport systems is not included in the social efficiency calculations. and does not seem to be taken into consideration in the overall assessment to a justified extent.

- Many people may feel hesitant about new developments in general – which may be expressed in their roles as responsible official, investigator and decision-maker.

- New developments can be counteracted by established actors from the point of view of self-interest.

- A general inertia in the social machinery can strengthen the two above effects. People often tend to rely on established actors.

Obstacles could be added to this list which are related to system faults in the planning process. All this, however, are questions that are to be dealt with tin a future summary report.

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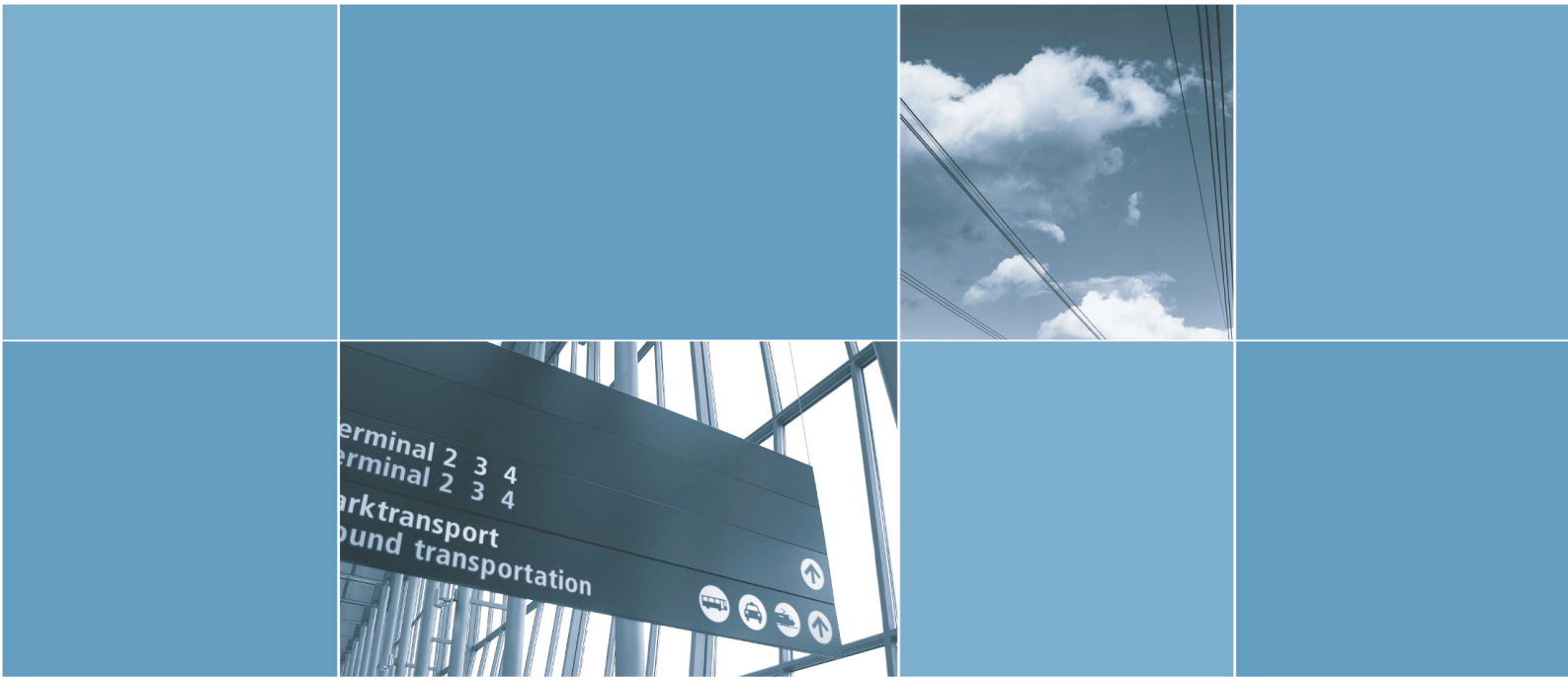

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