



CiViTAS
Cleaner and better transport in cities

**trend
setter**



Sustainable Urban Transport

Final report from the European project Trendsetter

Issued by: Environmental and Health Protection Agency,
City of Stockholm on behalf of the Trendsetter cities: Graz,
Pécs, Prague, Lille and Stockholm

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Photography: Gerhard Ablasser/Stadt Graz, page 18:1,
18:3, 21, 23:3, 25:1, 25:2, 26, 28, 32:1, 33:2, 33:3, 34:1,
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Printed: 2006 by åtta.45, Stockholm

Foreword

Sustainable Urban Transport is a key task for European cities. Increasing road traffic with resulting congestion and environmental problems and the increasing dependency on finite oil resources is an important issue to address for urban areas. The cities of Lille, Graz, Prague, Pécs and Stockholm demonstrated and evaluated more than 50 different ways to reduce these problems by implementing radical and innovative sustainable urban transport measures during the years 2002 to 2006.

These efforts were carried out in the TRENDSETTER-project (Setting Trends for a Sustainable Urban Mobility) and were co-financed by the European Commission. For the cities involved, the project helped focus on these issues of sustainable transport. The project also brought increased cooperation between the cities and other European cities, with support by the European CIVITAS programme.

This report summarises the results from the TRENDSETTER project and presents them so that the examples and conclusions can be used by other cities.

We hope that these results will help set a trend towards sustainable transport in Europe.



Gustaf Landahl
Co-ordinator

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Introduction and summary



Satisfying mobility for both people and goods is essential for the vitality of our cities, and a well functioning transport system is vital for a good life in the city. However, increased traffic may actually decrease mobility when people and goods get stuck in congestion. Increasing emissions and noise levels threaten citizens' health and make the cities less attractive. In the long term, the issues of climate change and energy scarcity also puts a demand to ameliorate the negative sides of traffic, while keeping the flow of people and goods high.



The Trendsetter project – one of four projects financed by the Civitas I Initiative – has tackled these problems. By setting good examples, the five participating cities Graz, Lille, Pécs, Prague and Stockholm can inspire other cities and show them how to facilitate sustainable mobility. Trendsetter also shows that by following our examples, cities can meet the Kyoto and EU goals for emissions.

Trendsetter has implemented 53 specific measures in different thematic areas that complement and reinforce each other. Advanced mobility management schemes and clean vehicle fleets are among these measures. The project has also promoted the use of public transport, other alternatives to private cars and showed new ways to improve goods logistics and efficiency. Furthermore,

Trendsetter has increased the acceptance for bio-fuels among citizens and encouraged operators, politicians and social groups to use innovative, low-noise and low emission technology.

The measures and their outcome are presented in this report under the headings:

- Smart ways to travel – promotion of alternatives to private cars
- Improved goods distribution
- Clean vehicles – a way to reduce emissions

The results are intended to encourage other cities and as an input to European policy making. Trendsetter is setting the trends for a sustainable transport future in Europe.

Road traffic increases

With better economy, travel usually increases. In Europe, goods traffic has increased by 75% and passenger movements by 110% in the last 25 years. The increased standard of living has also boosted consumption, thus increasing the transportation of goods. The increase has been strongest in road transport, though shipping and rail traffic still have a large share of goods transports. Forecasts show that passenger transport as well as goods transport will continue to grow.

“Cities are key actors”



Viviann Gunnarsson,
vice mayor in Stockholm

“Trendsetter has proved that cities are key actors and that their work is crucial for improving the environment. Stockholm has shown that ambitious investments such as traffic management and congestion charging make a big difference, but also that small and inexpensive measures such as bus priority systems can make important contributions. In Trendsetter, Stockholm also shows that a combination of carrots and sticks is an efficient way of making people change their behaviour, and has resulted in 3,000 clean vehicles sold to private companies.

I am proud that Stockholm is part of Civitas, and I believe that Stockholm’s experience can easily be transferred to other cities. The Civitas initiative has made this possible, and the exchange and experience shared among the Trendsetter cities is very valuable for the future. The many fruitful contacts will lead to further exchange and facilitate further European co-operation. Trendsetter has also improved internal cooperation within our city.”

“Trendsetter has further motivated us”



Eric Quiquet, Vice-President of Lille
Metropole in charge of urban transport

“In 2000, as the European Commission launched the Civitas programme, Lille Metropole had just adopted ambitious policies for the next ten years, including the Urban Mobility Plan, the Local Safety Plan and the purchase of 100 new biogas buses, with the target of a 100% clean public transport service.

The dynamics of Trendsetter in the cities of Graz, Pécs, Prague and Stockholm is a further motivation for our local and regional partners involved in the tricky but exciting challenge to create sustainable urban mobility. Our political commitment is to implement the Kyoto protocol objectives on the local level, as the world needs every city to contribute. Each partner in Trendsetter has made a tremendous effort.

In 2005, Lille Metropole has implemented the expected measures related to fare integration, public transport security, intermodality through adapted infrastructures, public transport efficiency through dedicated operation schemes, clean vehicle operation and biogas production and fuelling. This has of course benefited Lille Metropole, but we have also made fruitful exchanges with our colleagues from other cities.”

“CIVITAS has got things moving”

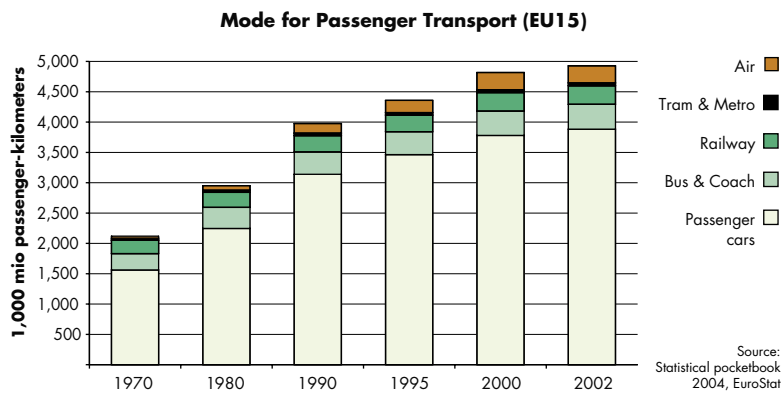


Gerhard Rüscher, City Councillor of
Graz, Transport and Urban Planning

“The city of Graz was among the first in Austria to participate in EU-programmes. CIVITAS is one more link in a chain of successful EU-programmes – this time in the field of transport and environment. The CIVITAS-initiative has shown that joint action among cities can get things moving within Europe. On the one hand, we can learn many things from our partner cities, and on the other hand, Graz has gathered a lot of experience that it can share with other cities.

In the field of clean vehicles we have shown – within the framework of CIVITAS – that not only is it possible to operate the whole public transport fleet with 100% biodiesel processed from used cooking oil, but also to run taxis on biodiesel – lowering environmental impact and CO₂ emissions. In the field of soft measures, Graz is also a pioneer: both mobility management for companies and schools and a fully integrated mobility centre are good examples.

Many measures would not have been possible without the participation and support from the CIVITAS programme, and as councillor I must say that the city of Graz has certainly profited from CIVITAS.”



The increase in transport is the result of changes in the production system as well as the consumers' altered preferences. The following trends are often mentioned as causing traffic growth:

- **Globalisation of trade and industry and the European common market leads to**
 - Increased goods transportation in e.g. the food industry.
- **Increased economic prosperity.**
 - We can afford to travel more frequently and longer distances as well as consume more faraway products.
- **The development of the network society in combination with globalisation results in many and faraway contacts.**
 - More people travelling long distances.
- **Wider labour market.**
 - Wider labour market and access to education increase the need for travelling.

Mobility decreases

Goods traffic and passenger movement increase, but many cities experience decreased mobility. The increasing use of private cars counteracts mobility and many cities suffer from severe congestion problems. In some cities, the average speed during rush hours is actually only about 15 km/h – or even less. Building new roads can only

occasionally and temporarily solve this problem. Hence there is a strong demand for fast and smooth mobility solutions that do not increase congestion.

Emissions increase

Vehicle emissions affect both citizens' health and living environments. Road traffic is responsible for almost 70% of the emissions of NO_x, particles and harmful hydrocarbons in cities. In a city like Stockholm, emissions from road traffic cause the same average reduction of life expectancy as traffic accidents do. The European air quality directive sets limits for pollutants in the air, but with increasing traffic, it is difficult to fulfil the directive. Many pollutants also end up in rivers and lakes, causing damage to wildlife and fish and may also affect drinking water quality. Climate change is a growing threat to Europe as well as the rest of the world. Road transport is currently responsible for about 30% of the emissions of CO₂ and this share is increasing. The Kyoto protocol states that EU countries should cut their emissions of greenhouse gases by 8% by 2010. The increase in road traffic makes this goal increasingly difficult to reach.

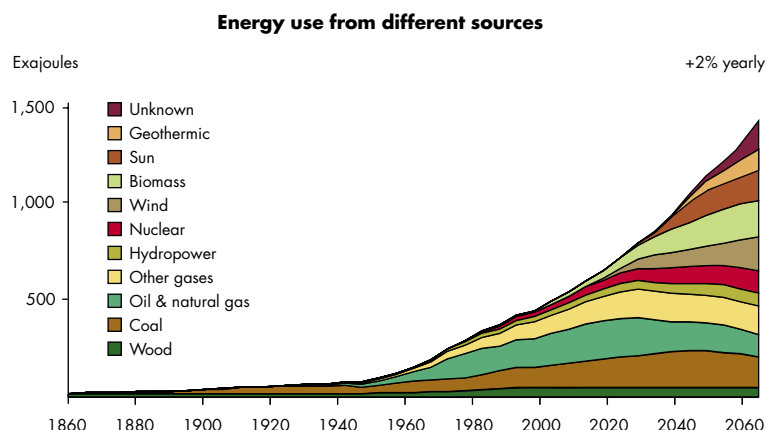
Traffic also causes noise problems. According to the World Health Organisation (WHO) more than half of the citizens in Europe live in noisy surroundings and a third of the citizens experience noise levels that disturb their sleep.

Energy consumption increases

Energy consumption is currently growing by 2% per year and the developing economies in China, India and South East Asia will further increase the growing rate. At the same time, oil is expected to peak in 20 years, leading to both higher prices and political instability. Road transport stands for a major part of the energy consumption in cities and is almost totally dependent on imported oil from a few countries. A major concern is therefore to decrease the use of energy and to replace oil with other energy sources.

Historical facts and future forecast assuming a continued 2% increase per year. This graph assumes that oil peaks in 2030. Later research shows that the peak may come even earlier.

Source: Shell International Petroleum



Trendsetter shows scope for sustainable cities

The road to success can seem long and winding for a city striving to become more sustainable. Efforts needed in order to change infrastructure and citizens' habits may feel complex and expensive. However, Trendsetter and other European projects have shown efficient ways to reduce car use, make public transportation efficient and competitive and thus make European cities healthier, less energy demanding and more attractive.

There are immense efforts going on within Europe to implement measures for achieving sustainable transport systems and societies. Lessons learnt in Trendsetter cities can serve as a toolbox for ambitious followers.

Sustainable Urban Transport Plans

To improve the transport sector from an environmental point of view, long-term strategies are crucial. A Sustainable Urban Transport Plan is a tool for structuring plans within a city or region. Not only cities, but also regions and nations must work according to long-term strategies to curb urban transports. The strategies could include actions to increase the efficiency of transportation and logistics, substitute conventional vehicles and fossil fuels with clean vehicles and renewable fuels, plan and create a society with less need for transport, and influence the demand for transport.

Achievements within Trendsetter

Measures within Trendsetter differ in efficiency regarding the reduction of emissions, energy consumption and increased mobility for citizens. They also require different time-spans and funding. This report presents a summary of different measures for enhancing public transport, promoting sustainable alternatives to car use and controlling traffic flow, according to their impact and efforts needed.

The overall perspective

Working within Trendsetter has given the participating cities a chance to learn from each other and compare practices. Trendsetter has helped the cities to implement local projects, to show this work to other cities and to show Europe what cities can achieve. Not only has the cooperation between the cities been worthwhile – the cities' own local work and institutional networks have also been developed and strengthened through the European dimension. Because of the overall Trendsetter framework, local work has been more structured and well planned in some



cases. It has also been easier to push innovative ideas within an EC-financed project.

Improving access to public transport

All Trendsetter cities have made large efforts to improve the public transport system in order to attract more passengers. Some of the measures have aimed at improving the access to public transport, and others to facilitate trip planning for smartest choice.

Sustainable Urban Transport Plans might become mandatory

The European Commission has proposed that all cities with more than 100,000 inhabitants should describe the movement of goods and people and its conditioning factors and impacts in a Sustainable Urban Transport Plan (SUTP). The SUTP should apply for 5–10 years, but the actions and budgets should be revised every 1–2 years. The plan should be embedded in an overall development strategy with a long-term perspective of 20–30 years. The SUTP should integrate transport and mobility with other key planning, especially for land-use, environment (e.g. Environmental Management Plans), social inclusion, economic development, safety, health and education.

Lille has improved the safety and security of their public transport system, using both technical equipment and additional personnel. Lille also implemented integrated fares in the region. Both Stockholm and Lille have prepared for implementation of a smart card system. The improved safety and security, the fare integration system, Park&Ride facilities, creation and improvements of multimodal nodes and the implementation of high level of service bus lanes support an increased use of different forms of public transport in Lille.

In Graz, 60 bus and tram stops, situated at important junctions, were rebuilt and improved to make them more customer-friendly. Both Stockholm and Graz have increased the quality of services in the public transport system by using regular quality surveys, real-time information at bus stops and on the Internet, a travel guarantee for delays, mystery shoppers reporting on quality, and incentives for contractors to perform better.

To make the buses more efficient, dynamic bus priority systems have been implemented in Prague and Stockholm, while Lille has introduced a bus lane with high-level service, the first in a future series of twelve similar bus lanes. New bus lines for special needs have been implemented – one to a hospital area in Prague and one between Graz and its suburbs on weekend nights. The attractiveness and image of public transport has also been improved by the introduction of biogas buses in Stockholm and Lille and biodiesel buses in Graz.



Trip planning, traffic control and cycling

To make it easier for passengers to plan their trips, Trendsetter cities have introduced real-time information systems with information on arrivals and departures, trip-planning tools on the web, and mobility centres.

By controlling the traffic flow with e.g. traffic lights and motorway systems it is possible to

achieve a smoother flow, avoid congestion and accidents and decrease emissions. Within Trendsetter, both Graz and Stockholm have implemented traffic management systems that collect and analyse real-time and static data.

Bicycle measures aim at making cycling more attractive. Both Stockholm and Graz use Internet route planning to help cyclists plan fast and safe routes. Graz also focuses on bicycle training for children and bicycle audits. Within Trendsetter, Graz and Lille have worked to make cycling an attractive alternative even on longer distances by marketing cycling, extending the cycling network and equipping tram and bus stops and metro stations with Bike&Ride facilities.



Access restrictions for reduced traffic

Different types of access restrictions have been demonstrated within Trendsetter. Graz has implemented strolling zones in the city centre. Pécs has implemented a car-free zone, zones restricting heavy vehicles and a zone-model parking system. In Prague, the access restrictions for transit traffic have been extended and stricter rules have been adopted for part of the zone. Stockholm has increased compliance within the existing environmental zone, which prohibits entry by heavy vehicles older than eight years. Stockholm has also worked with congestion charging – a full-scale trial will be implemented in January 2006.

Marketing and mobility management

Marketing activities have shown to be an effective way of changing peoples' behaviour and encouraging them to choose public transport. Stockholm has identified new inhabitants in specific neighbourhoods, and companies with an environmental profile, as important targets for direct marketing campaigns. Graz has focused on image strengthening and has carried out 'unconventional' marketing activities.

In Graz, mobility management has been given priority for several years. Mobility management for companies, schools and big events is carried out within Trendsetter. Lille has implemented a mobility plan for its 2,200 employees, setting a good example for private companies.



Co-transportation of goods

Graz and Stockholm have shown that consolidation of goods reduces transports and their negative environmental impact. A logistics centre has been established in Graz, consolidating retail goods. In Stockholm, one logistics centre handles deliveries to a large construction site and another handles deliveries to restaurants.



Clean vehicles and fuels

Trendsetter has shown that biofuels are suitable options for city buses and car fleets and that it is possible for a city to inspire and support private companies. This starts off the development of a clean vehicle society. Within Trendsetter, biodiesel, biogas, ethanol and electric hybrid vehicles have been demonstrated. Infrastructure for biodiesel (Graz) and biogas (Stockholm and Lille)

has been set up. A new major biogas production plant in Lille – the largest in Europe producing biogas from organic waste – is under construction.

More than 230 buses, fuelled with biodiesel or biogas have been demonstrated in Lille, Stockholm and Graz. Other heavy vehicles, e.g. nine waste freighters and five trucks in Stockholm, have also been taken into operation. Clean vehicles have been introduced both in city fleets and private company fleets. Lille Metropole has 55 new gas cars in their city fleet. Graz has worked together with one of the large taxi companies, which has now converted approximately 40 vehicles to biodiesel. Within Trendsetter, Stockholm has introduced more than 320 new clean vehicles in the city fleet, and more than 3,000 in private company fleets.



Incentives and promotion of clean vehicles

Incentives such as reduced parking fees and subsidies for extra vehicle costs have been used as a tool to increase interest in clean vehicles. In Stockholm, clean vehicles are excluded from congestion charges, which can save the driver up to €130 per month. Demanding clean vehicles and fuels when procuring transport services or vehicles has also shown to be effective. In Stockholm, other promotional activities, e.g. test fleets for companies, networks of clean drivers, and websites promoting clean vehicles have been carried out.

Overall assessment of achievements within Trendsetter

The table below shows an overall assessment of the achievements within Trendsetter. Emissions, energy and mobility, time needed to implement the measure, as well as investment costs and operational costs are described.



Areas	Categories	Emissions	Energy	Mobility	Time	Investment cost	Operational cost	See page
Convenient access to public transport	Integrated fares and smart cards	◆◆	◆	◆◆	■ ■ ■	● ●	●	15
	Increased public transport security	◆	◆	◆◆	■	● ● ●	● ●	16
	Convenient and safe intermodality	◆	◆	◆◆	■ ■	● ● ●	● ● ●	17
	Customer-friendly stops	◆	◆	◆	■	● ●	●	18
	Dedicated bus lanes and priority at junctions	◆◆	◆◆	◆◆	■ ■	● ●	●	18
	New services for special needs	–	–	◆	■	●	●	20
	Quality management	◆	◆	◆◆	■	● ●	● ●	21
Trip planning for smartest choice	Real-time information helps staff and passengers	◆	◆	◆◆	■ ■ ■	● ● ●	● ●	23
	Planning trips on the web	◆	◆	◆◆	■ ■ ■	● ●	●	24
	Integrated public transport services	◆	◆	◆◆	■ ■	●	●	25
Traffic management	Traffic management	◆◆	◆◆	◆◆	■ ■ ■	● ● ●	● ●	28
Cycling	Cycling	◆◆	◆◆	◆	■ ■	● ●	●	31
Access restrictions	Zones favouring pedestrians makes cities attractive*	◆	◆	–	■ ■	● ●	●	33
	Selective access restriction for heavy vehicles	◆◆	◆◆	–	■ ■	●	●	34
	Congestion charging	◆◆	◆◆	◆◆	■ ■ ■	● ● ●	● ● ●	36
Marketing attractive alternatives	Marketing	◆◆	◆	◆◆	■ ■ ■	● ●	●	38
	Mobility management	◆	◆	◆◆	■	● ●	●	38
Improved goods distribution	Consolidation of goods *	◆	◆	◆◆	■ ■	● ●	●	44
Clean vehicles and fuels	Biofuel production	◆◆	◆	–	■ ■	● ●	●	52
	Biofuelled vehicles	◆◆	◆	–	■ ■ ■	●	–	53

* Measures that mainly have local effect

Effects on Emissions, Energy and Mobility

Small ◆
Medium ◆◆
Large ◆◆◆

Implementation time

Short ■
Medium ■ ■
Long ■ ■ ■

Costs for cities

Low ●
Medium ● ●
Large ● ● ●

Costs are divided into Investment costs and Operational costs. Costs here refer to costs for the city to implement the measure.

Time – time to implement the measure.



Convenient access to public transport increases the attractiveness of public transport. Most of the measures have a large effect on mobility and slightly less on emissions and energy. **Integrated fares** are an important step for convenient access. This involves many organisations and usually takes time, but is successful when implemented. **Smart cards** are a tool for integrating fares.



A high sense of **security** is a prerequisite for attractive public transport. The actual security level and passenger perception of public transport security vary from city to city. In Lille, security was prioritised and large sums were spent on technical equipment and personnel. Measures aiming at

convenient and safe intermodality can vary in extent, from small Park&Ride facilities to complete reconstruction of railway stations. Thus, costs can vary widely. **Improvements to public transport stops** can be implemented relatively quickly and inexpensively.

Dedicated bus lanes are efficient to give buses priority in the transport system. Implementing **bus priority systems** at junctions is also efficient and is less expensive, especially as it is possible to start on a small scale, with only a few crossings. **New services for special needs** are important for the mobility of certain customer groups, but have little impact on emissions and energy in the city as a whole. **Quality management** increases the quality of the service and thus mobility. The investment cost is low, but operational costs are higher due to staffing.



In order to be an alternative for many citizens, using public transport must be as efficient as using the private car. To be able to **plan the trip** and find the smartest choice is important. To implement systems using **real-time information** and **trip planning** takes time and can be expensive.

Real-time information helps passengers to plan their trips, and requires staff in the public transport system to inform passengers when disturbances occur. Planning both single and multimodal trips on the web is a growing alternative in many cities. The effect varies depending on Internet access, public transport service and the quality of the trip planner. **Integrating public transport services**, as done at the mobility centre in Graz, improves mobility. With increased use of public transport, operating costs are reduced by the increased sale of tickets.

Traffic management has large potential, but takes time to implement and is expensive. Efficient use of available infrastructure can reduce the environmental impact and increase mobility. If increased efficiency in the transport system results in a total increase of traffic, the environmental gains and energy savings disappear.

For shorter trips, **cycling** can be an alternative to taking the car. Introducing measures that increase cycling can reduce emissions, noise and congestion in cities. Especially in rush-hour traffic, a limited reduction in the number of cars can significantly improve traffic flow.



Access restrictions reduce emissions and energy consumption. **Congestion charging** also has a large potential for increasing mobility. Experience from London shows that congestion levels are lower, as is the number of vehicles entering the congestion zones. Emissions and noise

levels have also been reduced. The successful implementation of congestion charging takes a long time. High operational costs are compensated by revenue from the system, which might exceed operational costs after a certain time frame. Congestion charging affects the traffic situation within the whole city, while **zones favouring pedestrians** have a local effect. **Selective access restrictions for heavy vehicles** have large potential for reducing emissions, as heavy-duty vehicles are responsible for almost half of the harmful emissions in cities and most of the high noise levels. Implementing restrictions for heavy vehicles is cheap for the cities, but in some cases, transport companies will have to invest in new vehicles. Surveillance is crucial for positive effects.

Marketing and image-strengthening activities are efficient and relatively inexpensive ways to increase the number of public transport users. The measures can be implemented quickly. However, it may take a long time to change people's behaviour.

Mobility management can contribute to a change in awareness and education towards sustainable mobility, through actions and strategies for fulfilling transport needs.

Consolidation of goods, i.e. when goods are co-transported, can really increase mobility and solve congestion problems. These effects, as well as the positive effects on environment and energy, are usually local.



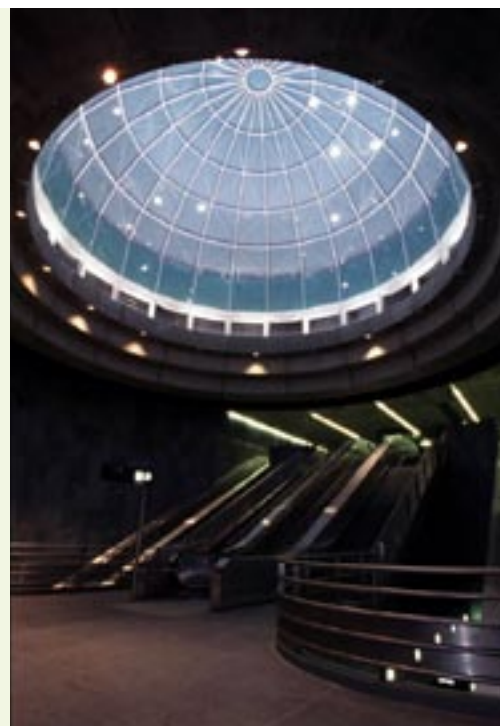
Biofuelled vehicles reduce emissions, especially CO₂. The consumption of fossil energy is reduced, but not always the total energy use. Heavy vehicles can have high energy consumption compared to their diesel counterparts, especially in low gears, which is often the situation in city centre traffic. Clean vehicles perform as good as fossil-driven vehicles. Costs, however, vary between different fuels and technologies. The investment cost is higher, especially for heavy vehicles. Operational costs are similar to fossil-fuelled vehicles but can also be lower, which is the case for biogas and ethanol-fuelled vehicles in Sweden and biodiesel in Austria. Implementing biofuelled vehicles takes time, as the infrastructure has to be in place and attractive car models must be on the market.

Overall conclusions, recommendations and lessons learnt

Overall conclusions



- + Trendsetter has contributed to developing attractive cities and improved quality of life for citizens. Congestion has been reduced as well as emissions, greenhouse gases, energy consumption and noise levels. Mobility has improved.
- + Trendsetter measures can be used to support Kyoto protocol and European air quality directives.
- + The Trendsetter project has been a strong driving force for politicians and officials in the cities to implement new measures. Graz and Lille, being cultural capitals during the Trendsetter time period, have used the project to advance measures already planned. Pécs used the World Heritage title as a driving force.
- + The Trendsetter experience can be used as a model when discussing Sustainable Urban Transport Plans.



Practical lessons

- + Information and early involvement of relevant stakeholders is vital for the success of many measures.
- + Legislation and regulations must be checked before implementing any activity.
- + The variety of measures complicates the evaluation of initiatives. A combination of qualitative and quantitative methods is needed.
- + Communication, information and marketing directed at different target groups are important for success. Soft measures can be cheap and efficient, especially when combined with infrastructure investments.
- + Time is needed to create new habits.
- + The 53 measures implemented in Trendsetter vary in their degree of innovation. Both innovative and non-innovative measures have been successful.

Recommendations to the European Commission

- + There are immense efforts going on in Europe to achieve sustainable societies and transport systems. There is a large potential for dissemination of best practice, worst practice and lessons learnt, to other cities.
- + European cooperation is essential and should be supported.
- + Establish an informal forum where the local and European levels can meet, discuss and find ways to solve European concerns of urban mobility, energy and emissions. EC should also support European workshops in different areas.
- + Continue supporting applicant countries and prospective EU members to enable them to gain as much knowledge as possible from other countries/cities. Experienced EU cities also need financial support for the transfer of knowledge.
- + Support development of new methods concerning cost-benefit analysis, also taking soft parameters into account.

Important lessons learnt from measures

- + When using public transport, passengers strive for smooth and few interchanges. Measures targeted at developing this are vital in order to make public transport more attractive, e.g. easy and integrated ticketing with smart card systems, Park&Ride facilities, secure parking places for bikes, real-time information systems at stations and web-based trip planning tools.
- + Communication, information and marketing are important when trying to increase the use of public transport and other modes of sustainable transport. Soft measures are inexpensive and efficient, especially when combined with infrastructure investments.
- + With traffic management systems, existing infrastructure is used more efficiently. A traffic management system is a good tool for reaching goals regarding congestion, emissions and traffic volume. For example, well-tuned traffic signals are very efficient for reducing congestion. Traffic signals giving priority to public



transport is also a successful, easy and relatively inexpensive measure. It is cheaper to implement traffic management systems than to invest in new roads.

- + To increase cycling in cities, a combination of soft measures (e.g. marketing, children's education) and hard measures (e.g. B&R, bicycle lanes) is successful. Increase infrastructure and provide sheltered and theft protected cycle racks, especially close to metros, commuter trains and bus stops. Information on the Internet is also useful, as well as campaigns and education. Health arguments and the fact that cycling saves time and money often work better than environmental arguments.
- + Access restrictions can lead to less traffic, improved mobility and less noise, which means higher quality of life with a more accessible and attractive city centre. It is important to gain approval for car-free zones and strolling zones, both by politicians and citizens.
- + Environmental zones can be good tools for reducing heavy traffic in cities. By only allowing fairly new vehicles, a renewal of the fleet will be accomplished and emissions reduced. By prohibiting trucks over a certain weight, congestion, emissions and noise decrease.
- + Local authorities are key players for promoting clean vehicles. They can start the market development by making municipal fleets and city bus fleets clean. Private fleets such as taxis can follow, and a broader public can be addressed once there are sufficient fuelling stations, car models, incentives, etc.
- + A complete value chain of biogas from its production from organic waste to its use to fuel public transport buses is technically feasible and economically viable.



Smart ways to travel

– promotion of alternatives to private cars



All over Europe the ambitions are the same: An increase in the number of public transport passengers and a reduced number of cars in city centres. In the long run, the ever-increasing traffic cannot be met by cities continuing to build new roads. Apart from being very costly, roads also use up space to the detriment of other activities, such as housing or green areas. Sustainable cities are reached through measures that provide attractive alternatives to the use of private cars.

Convenient access to public transport



There are many reasons why people do not travel with public transport. They may find the service slow, fares and ticketing complicated, or interchanges inconvenient. Some might not feel safe or find the buses and trains unclean. It is possible, however, to build public transport systems that tackle these problems. It is also possible to build systems where buses do not get stuck in traffic jams, or where travellers are persuaded to leave their car at a Park&Ride or cycle.

When designing a public transport system it is important to listen to passenger needs and opinions. It is also crucial to regard public transport as the backbone of the city traffic system. Single actions are not sufficient – the whole system must be improved in order to become more attractive. This also requires good coordination and cooperation between transport authorities, public transport companies and operators. Also, large investments are often necessary and politicians must have long-term mobility strategies for their cities.

Committed cities can change mobility patterns

There are cities in Europe where actually more and more people travel by bus, tram, metro and other forms of public transport. Several projects around Europe try to make alternatives to cars more attractive. The number of satisfied passengers has increased in the Trendsetter cities Graz, Lille and Stockholm after intensive work over several years. The efforts include better traffic information systems, new public transport nodes, quality management programmes and incentives for contractors.

Integrated fares and easy ticketing with smart cards

One way of facilitating travel with public transport is to integrate different operators and modes of transport into the same fare system. Removing complicated fare structures through fare integration makes travelling more convenient and increases the use of public transport.

Easy ticketing is another tool that makes public transport more attractive. Introduction of a

smart card system is a popular solution for most users. It has already attracted new public transport users in many cities. Sophisticated statistics from the cards also make it easier for cities to optimise their public transport operation. More travellers and better operation efficiency compensate for the extra costs when changing the system.

Smart cards make travelling easier

Both Stockholm and Lille Metropole will introduce secure and intelligent smart card systems. The system makes it easier for the traveller to pay and for the public transport operators to manage their income. Smart cards also generate exact information about how and when people travel. These facts can be used to customise public transport services to suit actual travel needs. Furthermore, smart cards can be used for advanced pricing models, where the traveller is charged according to travel length or time of day.



Bus, taxi museum – use the smart card

Another way to use the card is for payment of other transport services, such as the national railway or public transport in other cities. Parking fees, car sharing and taxi are other services that could be integrated. Bremen and Brussels are examples of cities where the card can load tickets for museums, theatres or other services and special offers in the city. Stockholm plans to include an electronic purse function in the smart card.

Integration promotes public transport in Lille

Lille Metropole has a new integrated fare system since September 2004, due to the cooperation between Lille Metropole and the main operators in the area, Transpole and SNCF, but also the Nord/Pas-de-Calais Area. The integration was negotiated by Lille Metropole and required a complete revision of the fare integration strategies in order to allow adequate ticketing solutions.

The Metropolis, the region and the district are all involved in the new organisation Syndicat Mixte, which implements the new fare integration. To further optimise the impact of fare integration, smart cards will be implemented.

Coordination of public transport

In cities where several organisations offer public transport services, information centres and ticket sales are often scattered in different locations. This is inconvenient for passengers. By integrating the service organisations, customers can get better information about all matters concerning public transport.

The Mobility Centre in Graz is a “one-stop-shop”, where the service organisations of three operators have gathered in the same location, after having an integrated fare system for several years. Before the integration, their service organisations were located at three different sites. The new centre provides high quality information and has resulted in more passengers, and thus higher revenue.

Increasing public transport security

Many people feel uneasy or even anxious when using public transport. But there are ways to make people feel safer and more willing to choose public transport:

- Rapid intervention in case of problems.
- More human presence in metros, buses and trams.
- Better cooperation and communication between public transport operators and the police.

Real-time information systems can also increase the feeling of security. If the traveller knows exactly when the bus arrives, he or she can e.g. avoid waiting at a deserted bus stop.

New Smart Cards in Stockholm

The public transport authority in Stockholm, SL, has over 650,000 passengers travelling each weekday with buses, trams, metro and commuter trains. Introducing a new ticketing system is one of several steps for providing higher travel quality for the passengers. Substituting the old magnetic stripe system with smart cards will provide quicker ticket inspection, mainly on buses. It will also make it easier to introduce new fares and types of tickets, thereby encouraging new travellers. Besides, the smart cards minimise the risks of ticket forgery.

The introduction of the system started in 2005 and will be in full operation by 2007. It is based on a standard for authorities responsible for transport in Sweden and parts of Denmark. This increases the card's usage, as it could be used e.g. by commuters between Sweden and Denmark.

The procurement of the system took longer than expected. The supplier has not been able to deliver the system as fast as expected due to the underestimation of human resources.



Security work in Lille makes people feel safer

Lille has equipped all buses with on-board GPS-radios and implemented a strong cooperation with police and justice to fight insecurity. This way, emergency situations can be managed faster and travellers feel safer. The reduction of aggressions and vandalism is strongly supporting the increase in public transport trips from 100 million in 1998 to 200 million in 2015, which largely compensates the initial investment in infrastructure.

The number of public transport users feeling rather or totally secure rose from below 77% to a stable average of 85% between 2002 and 2005.

The security improvements are laid out in the Local Safety Plan from 1998, which emphasises:

- Rapid intervention in case of problems. This is managed through the localisation of intervention fleet via GPS and localisation of bus fleet, as well as increased human presence in the metro and on buses.
- Cooperation between public transport, police and court through better communication and common actions.
- Evaluation and follow-up of the impact of these actions.



Intermodal node connects buses and tramway with Park&Ride and Bike&Ride-facilities.

Better parking facilities help mobility

In Lille Metropole, new P&R facilities have been built. The aim is to reduce the use of cars in the city centre and to increase the use of public transport. At different intermodal key-points, nine new car/bicycle parks with surveillance service have opened with over 3,000 new parking places, and many more are to follow.

Three of the P&R areas are located along a new high level of service bus route, which further facilitates access to public transport.

Park&Ride made public transport more attractive

Graz used to lack parking spaces in the inner city. More than 5,000 cars parked in the city centre and citizens circling the streets looking for parking disturbed traffic and caused emissions. The interlinkage between trams and buses was poor, and journeys between districts outside the city could only be made by taking a detour via the city centre.

This has been solved by improved connections between buses and trams, replacing bus lines with trams and creating P&R facilities along the most frequented routes to the city centre. By restricting inner city parking, a further impetus to use the new parking lots was created, and they are now fully used.

In a survey at the tram station Mariatrost, 45% of all interviewed persons are regular users of the new P&R facility. 60% indicated that public transport had become more attractive with the new P&R facilities.

Multimodal nodes in Lille will cut travel times

A new intermodality node in the city Armentières, close to Lille, will interconnect all modes from cars and bicycles to taxis and regional trains. The drop zone and disabled parking will be modernised and pedestrian walks will be enlarged and made safer. Also, car traffic will be directed one way around the city block in front of the station.

Lille Metropole is preparing similar heavy infrastructure implementations in other towns of the metropolis, to reach a total of 12 intermodal nodes. Citizens are expected to substantially cut travel times with such infrastructure, avoiding peak hour traffic.

Convenient and safe intermodality

Smooth and well-planned interchanges, both in time and location, are vital for passengers. Crossing streets should be safe, and parking facilities must be adequate. Also, there should be no hazardous drop zones for cars leaving or picking up passengers. Travellers should be offered more nodes with different transport options and easier shifts between collective and individual transport. Park and ride facilities (P&R) make it easier for commuters to leave their car and continue with public transport. Other ways to further intermodality is by integrating tariffs and tickets and inform about multimodal travelling options.

Customer-friendly stops

Getting on and off the bus, tram or train has to be easy, especially for disabled travellers. Stops should also provide high service and security for waiting passengers. User-friendliness can be created with:

- Broad waiting areas, not conflicting with pedestrians, on pavements.
- Safe pedestrian crossings to get to the stop.
- Pedestrian-friendly environment.
- Buses and trams equipped with low steps to help the disabled and elderly.
- Special help for the visually impaired.

Services, such as real-time information systems, bicycle racks and waiting shelters are also appreciated.



Rebuilding stops in Graz

In Graz, there are 800 stops for buses and trams, 60 of which were rebuilt and improved within Trendsetter. The stops are situated at important junctions, close to the city centre or at the end of lines. They were provided with shelters and with surfaces ensuring accessibility for the functionally impaired. In one case (Andritz) the end-stop of tram and interchange to buses was transformed into an attractive public space for the whole district.

According to passengers, public transport has become much more attractive through the reconstruction. The only complaints concern the lack of green areas in the surroundings. The new kind of stops will be introduced step-by-step as standard.



Buses first – dedicated bus lanes and priority at junctions



Buses often get stuck in traffic jams, causing irritating delays for passengers. It also makes it harder for drivers to keep to the timetable. As buses also need to stop to let passengers on and off, travelling by bus often takes more time than going by car. One solution is a control system that gives buses priority at intersections. This reduces delays at traffic lights and increases the average speed. Another solution is dedicated bus lanes. Both these measures have been tried with good results within Trendsetter.

Dynamic bus priority

Ordinary bus priority signal systems give priority to buses, which improves the smooth running of

buses. However, on heavily trafficked streets, such signal systems still cause irregularities and bundling of buses. For passengers this means long delays, followed by a sudden surplus of buses. At the same time, these systems cause delays for other traffic. If the regularity of buses were better, urban traffic flows would also be smoother, causing less emissions and noise.

Dynamic bus priority systems have been introduced in Stockholm and Prague within Trendsetter. The system is based on computers at major traffic crossings that optimise the priority for every bus arriving at the traffic lights. The computer also communicates with computers in neighbouring crossings, giving input on when the traffic

or a bus is expected to be released. Sensors in the road also let the computer consider the time since a bus last passed, the number of waiting cars and pedestrians on crossing streets and the number of vehicles estimated within the nearest minutes.

A lesson learnt from Trendsetter is that traffic signal control needs to be an integrated part of the traffic management scheme in medium-sized and large cities. Road authorities need to cooperate with each other and public transport authorities should be involved in these activities.

Dedicated bus lanes

If buses share lanes with other vehicles, delays and irregularities often occur. Dedicated bus lanes with special traffic signals can be used to give buses total priority, making the bus almost as efficient as a tram. In fact, this is sometimes used as a first step towards introducing a tram.

Not everyone agrees that the extra road space should be used for buses. Some people believe it should be for private vehicles. Still, decision makers in some of the Trendsetter cities have successfully set aside road space for public transport use only.

Dedicated busline reduced travel times in Lille.



Bus priority increased bus speed in Prague

In Prague, a bus priority system was initially installed at two intersections. Even though it is a small measure, the reduction of time loss at traffic lights makes bus traffic faster and smoother. The system is based on radio communication between the bus and a signal-timing controller at the intersection. The priority system is linked to the timetables for determining the time difference in the schedule, which determines the priority for buses at the intersection. Buses ahead of schedule do not receive priority. Prague has now installed the same system at five additional intersections.

The evaluation has shown that reliability of the bus service is 100%. The speed for buses has increased as well as the number of trips with public transport. The quality of service is considered to be very high. Emissions and energy use are also reduced.

High service bus route popular in Lille

A high service bus route in Lille Metropole has made public transport more popular among commuters and reduced car traffic in the city centre. A total of 12 such routes are expected in the long term.

The development of this service required:

- Construction of bus lanes on existing roads (less space for cars).
- A bus location system to give buses priority at junctions, so that they can drive more frequently (every 5 to 10 minutes in peak hours) and with a higher commercial speed.
- Better accessibility for customers, layout changes of bus stops and interchanges and better timetable and journey information.
- Integration with a network of Park&Ride and other intermodal interchanges.

Dedicated lanes, a location system and commercial quality are the common characteristics of all the high service bus routes to be implemented in Lille Metropole.

Park&Ride schemes facilitate access to the high service bus routes. In order to attract passengers, free car parking and bus ride was proposed for about one year. Use only declined slightly when customers had to start paying.

Within Trendsetter, four of the twelve similar high service bus routes planned for the city were studied and one was implemented.

Adaptive traffic signals reduces travel time for both buses and cars

The system for bus priority (with adaptive traffic signals) has been installed at 11 intersections in Stockholm. For buses, the number of stops has decreased and travel time is reduced by 15–20%. Private cars also benefit from the system, with a reduced travel time of about 10%.



New services for special needs

Not all groups in society use public transport. Impaired or elderly citizens often have difficulties with accessibility. Other services are desired by too few citizens to be economically viable for the operators. Yet other areas are impossible to serve by ordinary buses because of physical constraints, such as narrow streets in old areas.

Flexible solutions, putting passenger travel needs in focus rather than the use of an existent fleet, can provide alternatives to private cars and still be cost-effective for the operator. The solutions often include the cooperation of different stakeholders, e.g. taxi, bus operator, city authorities etc, and will be a success if they find the true need of the citizens. Marketing is also necessary to make people aware of the alternatives.



Small city buses operate in narrow winding streets in Prague.

New bus line to hospitals in Prague

The Karlov area is an old part of Prague with narrow and winding streets. Ordinary city buses cannot operate in the area. Since there is a large number of hospitals and clinics in Karlov, both clients and employees had to walk long distances from the nearest metro/tram or use their car. Hence the area was rather congested and sometimes blocked by inappropriate parking.

To improve the situation, a new city bus line with small city buses was established. The buses are adapted for the disabled by special boarding and the line connects to important transport nodes, which makes it accessible for most users. The line was heavily marketed in the press and through a leaflet distributed on public transport vehicles, at stops and at travel information centres. A special slogan and logo were posted at bus stops.

In spite of doubt by parts of the transport company, the new bus line has been a success. In September 2005, a similar bus line was implemented in the same area, also operating in narrow streets.

Success for night buses in Graz



Since 2003, there are seven night buses every weekend night to the different suburbs of Graz. The regular seasonal ticket is valid on the buses. In order to improve ticket

control and the feeling of security, entry is only allowed at the driver's door. Apart from reducing the number of private cars, the night buses also reduce the risk of drunk driving.

The system was marketed by:

- Distribution of flyers with information about departure times, lines and stops.
- In the bars, young "passenger catchers" invited people of the same age to take the night buses.
- The night buses received much attention in the press and radio, as their introduction coincided with local elections.
- Articles were written and disseminated to the city journal BIG, student magazines and magazines of the city districts.
- The weekly newspaper "GRAZER" had a special edition for students, in which the city paid for an ad and an article about the night buses.

Despite the doubts of the public transport operator, the lines have been a success, with more than 2,500 passengers per weekend. The service may be extended to weekdays if a real interest is shown.

The exchange of experience with cities having existing night bus systems was very important when planning the system.

Quality management



Citizens want value for their money. They will not use public transport if buses and trains are not on time or are cancelled. Vehicles and surroundings should be clean and

drivers nice and friendly. Therefore, all public transport providers should really work systematically on quality of service.

In the Trendsetter cities Stockholm and Graz, passenger surveys and “mystery shoppers” are used to measure the quality of public transport.

Stockholm has also introduced a bonus/penalty system for operators that score high/low in these measurements. In both cities, all actors involved have become more aware of quality and customers, and operators and contractors are more satisfied with the service.

Incentives for contractors

In many cities, contractors conducting the traffic do not have an incentive to give passengers a better service than agreed. But since punctuality, friendliness and cleanliness often are vital for passenger apprehension of public transport, incentives for contractors to improve this can result in more travellers.

Bonus for successful contractors

Stockholm uses bonuses for contractors in order to get more satisfied customers. With passenger surveys as a base, SL has set targets for goals such as punctuality, cancelled traffic, cleanliness, revenue, satisfied customers and passenger apprehension of the service. The contractor receives a bonus if a certain level of improvement is reached, i.e. better than contracted. Non-compliance, i.e. worse than contracted, results in a penalty. Punctuality, cancelled traffic and cleanliness have worked best as criteria. When these criteria have shown good results, the customers are also more satisfied. Customer satisfaction is measured regularly and the result can be seen as a summary of how well all the criteria are fulfilled.

The experiences of this incentive-model are mutually positive. The incentives are now an important part of the contracts between SL and the operators.

Listen to the travellers

– receive more passengers

Twice a year, public transport passengers in Stockholm are asked what they think of the service quality. The public transport authority, SL, distributes an enquiry on-board the vehicles. At least 400 passengers are interviewed while handing in the enquiry. “Traffic disturbance information”, “Punctuality” and “Cleanliness” are the issues most people complain about, despite the fact that Stockholm public transport is among the top 10 in Europe in this respect. However, if the operator wants more passengers, these issues have to be the most important also for the operator.

The surveys have resulted in the introduction of real-time information at bus stops and on the Inter-

net. They also have resulted in a Travel guarantee and in training of personnel in how disruption information should be communicated. A manual has been elaborated for disruption situations, so that all transport providers will use a unitary, non-confusing, language.

Between 1998 and 2005, the level of satisfaction with the public transport system has increased by 8%, from 58% to 66%, and the number of passengers has increased by 60,000 per day, from 640,000 passengers per day to 700,000 passengers.

Mystery shoppers check the service

Graz and Stockholm have performed quality controls with “mystery shoppers”, who are hired personnel travelling with public transport and reporting quality of services. The transport operator is contacted if the minimum standards are not met. The aim is to persuade contractors to increase their efforts and to secure and stimulate improved quality of service.

Criteria that are checked are for example:

- Driver/ticket seller behaviour (friendliness and knowledge about public transport system).
- Functioning of signs inside the vehicle.
- Availability of secured disabled seating, map with public transport itinerary, tariffs etc.
- Cleanliness.
- Stopping behaviour (close to pavement).
- Keeping the schedule (early/late departure).

Over time, the negative reports have become fewer. And although some of the transport operators initially regarded the mystery shoppers as spies, the hidden checks are now considered important for improving the public transport system.



Mystery shoppers check service in Public transport in Graz and Stockholm.

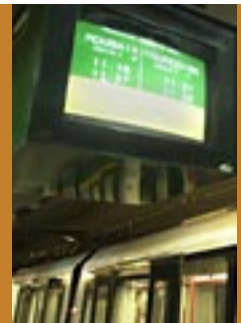


Conclusions and recommendations

Convenient access to public transport

- + For cities with several public transport operators using different pricing systems, fare integration is vital to facilitate travelling.
- + Smart cards make it possible to create databases with travel patterns, which can improve the planning of public transport.
- + Park&Ride facilities and secure parking places for bikes are efficient in order to make interchanges for passengers fewer and smoother and keep the private cars away from city centre.
- + Traffic signal control systems giving priority to public transport is a very successful, easy and relatively cheap measure to introduce in a city. Bus priority could be started at only a few crossings and still have positive effects.
- + Well-tuned traffic signals – also without bus priority – are very efficient instruments to reduce traffic congestion.
- + Safety/security, punctuality and cleanliness are very important for passenger acceptance of public transport services. Quality management could be used more frequently by operators, in order to reach a higher standard in public transports.
- + Innovative and relatively inexpensive measures can make public transport more attractive. Examples: Small city buses serving visitors to the local hospitals in Prague and a travel guarantee in Stockholm that safeguards travellers from time-delays in case of major traffic disturbances.
- + Quality of service should be benchmarked if entrepreneurs are used in the public transport system. Operators showing positive results in passenger surveys or other forms of quality measurement may be awarded bonuses.

Trip planning for smartest choice



Many citizens want public transport to be as efficient as travelling by car. It should be easy to compare travelling alternatives and plan a trip from door-to-door. Cities and public transport operators can use the latest technology to provide such information.

Real-time information on when the bus or metro arrives at the station, keeping track of delays, trip-planning tools on the web and mobility centres that integrate services are measures within Trendsetter cities to promote the use of public transport.

Real-time information helps staff and passengers

It is possible for passengers to find out when the next bus or train actually leaves, not only according to the timetable. Whether in a bus, at a station or at home, real-time information systems can provide such information. The advantages are more flexibility, less waiting time and safer waiting at nights when waiting at the bus stop until the bus departs can be avoided.

During the trip, updates can be available from screens, mobile phones and PDAs, as well as through loudspeakers. There can also be informa-

tion about walking distances when changing buses, trains or metros.

With updated information, staff can also answer passenger questions on delays and give recommendations on alternative routes.



Keeping track of vehicles

In Graz, trams and buses have been equipped with on-board transmitters that report the location of vehicles every tenth second to a computerised control centre. The information is used for real-time information to passengers, such as on-board-information of next stop, connections etc. One hundred bus and tram stops have been equipped with real-time signposts, giving information on when the next bus or tram will come, as well as on delays and other incidents of interest.

The information also makes it possible for central management to re-direct buses in case of accidents or to warn drivers about traffic jams. This has led to fewer disruptions and better traffic flow, further promoting the use of public transport.

Info wherever you are

A new real-time information system in Stockholm gives the latest information about public transport services and the traffic situation in general. New on-board computers are installed in 1,900 vehicles. A GPS signal every 30 second tells both the traffic control centre and passengers where a particular bus is and when it will arrive at a certain bus stop. The exact location of vehicles is always known. The system can also communicate with traffic lights to give buses priority.



55,000 people/day use Stockholm Transport travel planner on the web

Planning trips on the web

More and more citizens have access to stationary and mobile Internet. For travellers to be able to make smart choices for mode of transportation, planning-tools on the web are a growing alternative. Already, 50,000–55,000 people/day use Stockholm Transport's travel planner on the web to search for the best connection or to see if a bus or a train is on schedule. Passengers can also get information to handheld computers or mobile telephones.

Cooperation between all involved operators and integration of several data sources are crucial for developing the systems.

Websites help passengers to plan

Websites have been developed in Graz and Stockholm. Broadly they have two tasks: Making information about the current situation on all modes of transport available, and being a planning aid for travellers and commuters. The sites include information on road maintenance, major incidents and public transport disturbances. Basic information about schedules, fares, available parking, parking fees and information for cyclists is also available.

BusBahnBim in Graz



The web-based system "BusBahnBim" (Bus, Rail, Tram) allows a passenger to get door-to-door information, including tips on the best walking route between bus stops. The system was introduced in the region of Styria in 2003. For the first time, local public transport, including local and regional buses, was also included in the system. The introduction was promoted by marketing campaigns that directed citizens to the website www.busbahn bim.at.

Access to BusBahnBim increased from 64,000 customers in September 2003 to 260,000 in June 2005. The effect on the number of public transport customers is unknown. However, a study of the Mobility Centre has shown that their service has had a significant impact: about 20% of customers change their mobility behaviour in favour of public transport as a result of information obtained at the Mobility Centre. Therefore, it is very likely that information obtained from BusBahnBim also contributes to more people travelling by public transport.

Website in Stockholm helps passengers

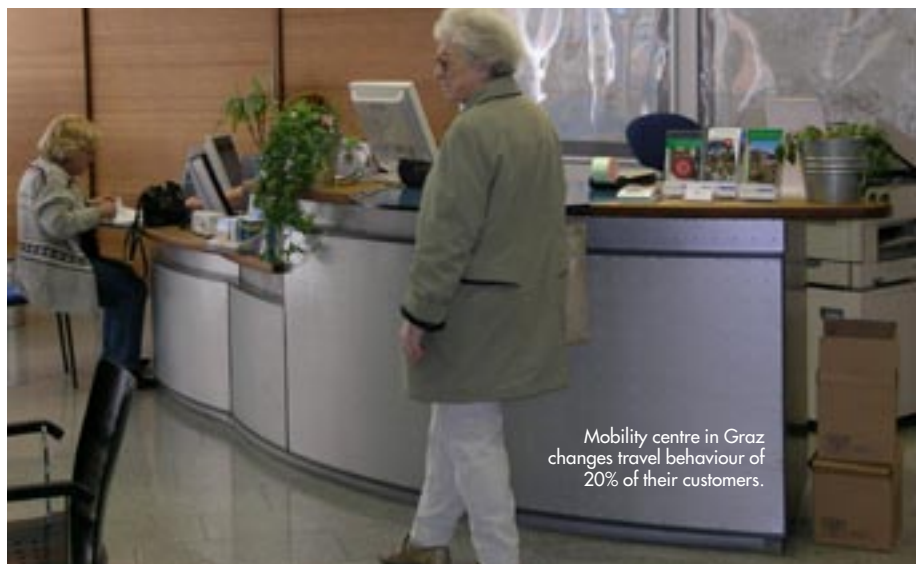
The already existing website www.trafiken.nu for trip planning in the region of Stockholm has been developed during Trendsetter. The site includes real-time information on main roads, route-planner for public transport and occupancy of Park&Ride facilities. It also informs about availability of public transport, timetables, the traffic situation and parking availability for travellers by car.

Innovative aspects of the project are the introduction of real-time travel time for some routes and smart choices for combined transport with e.g. bicycle, private car and public transport. Information on road maintenance, major incidents, and major traffic disturbances in the public transport system is included. The information is also available on mobile Internet, including WAP-technology. The website has 50,000–100,000 visitors/month depending on season.

Mobility centres integrate services

All information services on city public transport could be gathered under one roof. If travellers could find tariffs and timetables, buy all types of tickets and plan their trip completely at one place, public transport would be more attractive.

The first Austrian mobility centre, located in Graz, provided integrated information, but did not provide service from all operators. Some special tickets were not sold at the centre for technical reasons and lack of knowledge about the different service providers. There was also no access for disabled people and an increasing number of calls were lost due to overload in peak times. The operators decided to join resources in a mobility centre in order to improve services, which were implemented during Trendsetter.



Mobility centre in Graz changes travel behaviour of 20% of their customers.



Three ticket outlets turn into one mobility centre

The new mobility centre in Graz combines ticket selling of three former ticket-vending centres. It is strategically situated on the main public transport node, where 110,000 changeovers are made daily. The integrated centre is fully accessible to disabled people.

The centre also gives additional information and service regarding trips in the region, e.g.

- Touch screen terminals with web-based real-time information and door-to-door information.
- Real-time information displays reporting on departures outside the centre allow passengers to wait inside during bad weather or late in the evening.
- A bicycle service station.

The new centre has created synergies among the participating partners, for instance integrated computer systems and service, joint training of personnel, joint marketing, better distribution of work load in peak hours and low demand hours.

The centre increases access to and use of public transport and reduces operating costs by facilitating the selling of tickets. A study showed, that about 20% of the customers of the mobility centre change their mobility behaviour. This change generates additional revenue for the public transport companies and is at least twice as high as the investment costs and operating costs of the mobility centre. As the centre makes travelling with several operators easier, it is expected to increase the total use of public transport.

Conclusions and recommendations

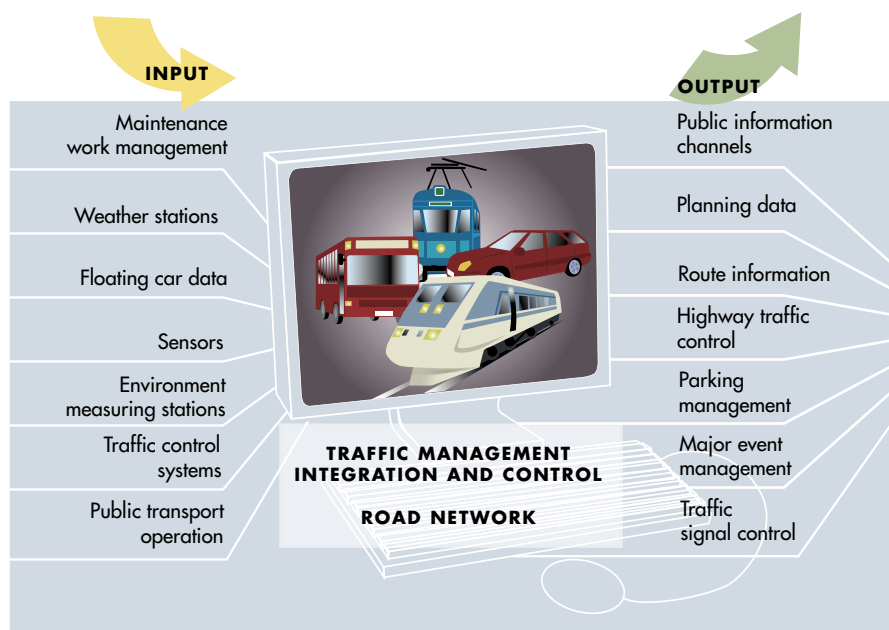
Trip planning for smartest choice

- + Real-time information systems that show when a bus or metro arrives and keep track of delays, make passengers more flexible and provide greater safety since the position of all public transport vehicles is known all the time.
- + Development of web-based trip planning based on real-time information is a cheap measure with big value for travellers, who can make smart choices for mode of transportation.
- + Integrated mobility centres might lead to a modal shift, which can lead to more revenue for the public transport companies.

Recommendations to EC

- + Support initiatives of local authorities to install door-to-door information in their city or region.

Traffic management



The number of roads, junctions, traffic lights and vehicles in large cities can seem never-ending. But it is possible to monitor the actual traffic situation in real-time and then control the flow using that information. This is what modern traffic management is all about.

Travel times vary depending on congestion, weather, accidents, road works, time of day, etc. The illustration above shows how information from different sources and systems interact in the complex “traffic management puzzle”. With reliable real-time information, better decisions can be made. Variable road signs or signals can change the speed limit, drivers can be advised to choose an alternative route and buses can be re-directed.

The collected data also forms a basis for traffic planning, analysing bottlenecks, steering inevitable congestion to areas where they disturb less, improve bus timetables and vehicle usage etc.

A full real-time picture of the traffic situation is also valuable for many other users – taxis, delivery companies or normal road users wanting to find the fastest route, unoccupied parking or a connecting train. This information can be available on the Internet, passed to an on-board route-finder or sent to a mobile device.

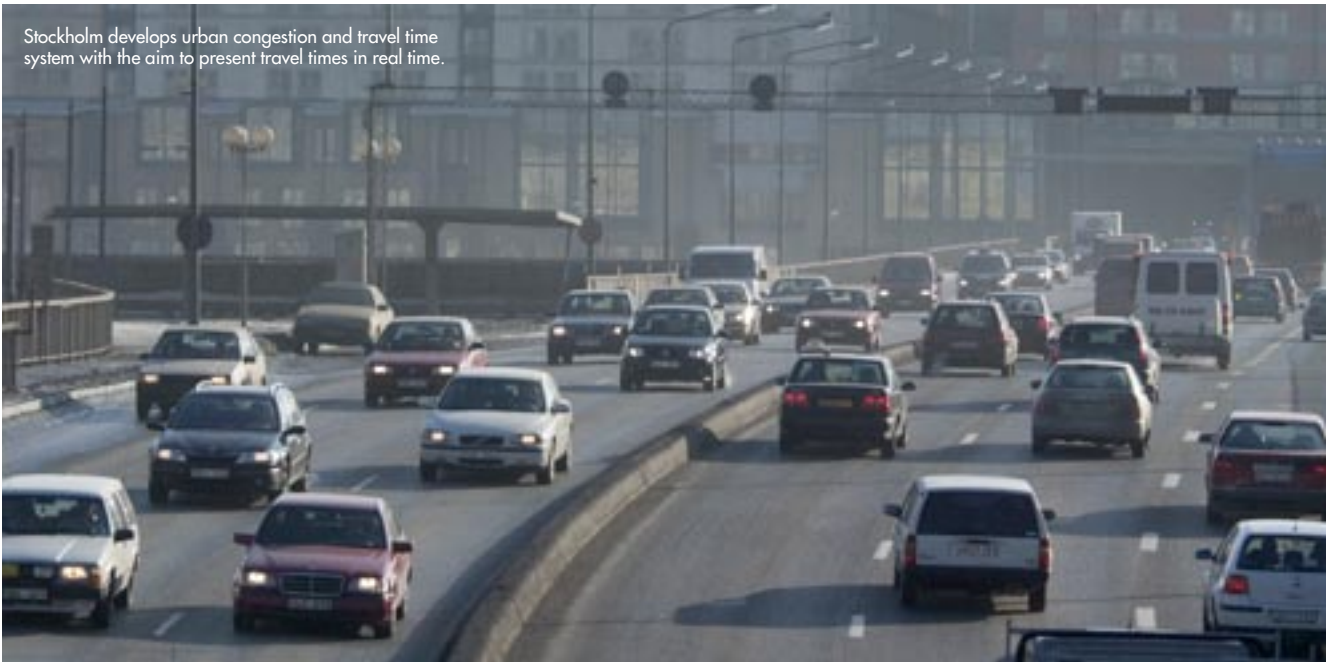
Thus an advanced traffic management system decreases the demand for new roads as existing roads can be used more efficiently.

Cooperation needed for collection of data

Public transport and big commercial fleet owners, like taxis, are pioneers in collecting real-time data from their vehicles. Road administrations typically collect a large amount of static data – speed limitations, one-way streets, parking regulations – but also dynamic data such as ongoing and planned maintenance or the number of cars that pass a certain point. Other relevant sources of information include e.g. parking garages providing information on the number of cars currently parked in the city.

The challenge is to connect all these data from various sources and to find ways to estimate the situation in areas where too little information is available, in order to give a reliable picture of the real-time traffic situation. What makes it difficult is that most databases are made to fulfil specific needs, other than those required by the traffic management system. They are not compatible with each other and do not refer to the physical road network in a common way.

Stockholm develops urban congestion and travel time system with the aim to present travel times in real time.



Urban congestion and travel time system in Stockholm

A large amount of traffic data is currently available, but no effective system has yet been developed to estimate travel times in real-time. However, the “urban congestion and travel time system”, aims to present travel times on the main road network in the big city regions of Sweden, with Stockholm as one of the areas. Another important aim is to combine traffic related data from different sources.

The travel time system and other traffic control systems will provide powerful information and support for the operators in the traffic management centre, but will also use the extensive information interchange for different types of analysis.

Integrating new modules for traffic control with the existing system took longer than expected. The data comes from different national and local systems, thus complicating validation of the quality of data.

Real-time online presentation of traffic situation in Graz

In Graz, traffic data from taxis (Floating Car Data) are combined with data from automated traffic counts and of a traffic control optimiser. A new model for data exploitation is applied in order to link different data sources with each other. For the traffic control system, the following interfaces will be established:

- Database of the street network, containing data about routes and traffic statistics.
- Radio control centre of taxi company 878, which runs a GPS system for their taxi fleet, by which the actual position and routes of the taxis are recorded (250 cars in the fleet have a GPS transmitter that automatically reports its position to a central database every 20 seconds).
- Central traffic computer, which records all data from over 500 counting loops and numerous specific values of the traffic control optimiser.
- Internet platform.



The system calculates the actual traffic situation, including congestion levels, average speeds of network sections and actual travel times. The system can also model the traffic status for two hours ahead and model the effect of network changes, including changes in traffic light programming.

The new system formed part of Trendsetter and was under time pressure to start. Still, the project was delayed for over two years due to negotiations with the province of Styria. Graz finally decided to continue without Styria. The experience shows that it can be good to separate a large project into smaller steps and, if possible, to decouple financing negotiations from implementation.

Simple in theory – difficult in practice

A common experience from Stockholm and Graz is that it takes longer than planned to build a specific traffic management system. One reason is that the system is technically complex. It is dependent on many sources and an incorrect value in a sub-system may affect the whole system. Tracking the error to the right sub-system is difficult.

Another reason for the delay is the large number of stakeholders involved, who have to agree on an issue that they do not immediately benefit from. It also requires a shift of role by road authorities – from building roads to optimising city traffic. As the system is complex and will take several years to benefit from, it can also be difficult to receive political/high-level priority – both cities have suffered from budget cutbacks.

On the other hand, collection of Floating Car Data has shown to be an inexpensive and effective way to “fill in the gaps” where less real-time information is available. One of the driving forces has been the need for information to commuters.

Economy

Traffic management systems are much less expensive to install than building new roads. However, the systems are complex and operational costs of collecting and validating data are rather high. There are often large communication costs and costs for quality assurance. Maintenance, e.g. closing down a lane, in the most intensive traffic environment is also problematic. There are also risks for increased traffic when congestion decreases. Sticks and good traffic management systems are needed to prevent this.

Stockholm has used the progress made in earlier EU projects, e.g. “Quartet plus” and “Cleopatra”. These systems are easy to adapt to a city since they have open specifications that can be connected to already existing systems. To buy a closed system and let the system provider adapt it to the city, is normally more expensive since local adjustments and behaviour can be a big problem.



Conclusions and recommendations

Traffic management

- + The existing infrastructure is used more efficiently through traffic management systems, which are cheaper than investing in new roads. But communication and operation costs can be high.
- + Traffic management systems are recommended in larger cities where different sub-systems need to be coordinated.
- + There are risks for increased traffic when congestion decreases. Sticks and good traffic management systems are needed to prevent this.
- + Knowledge from earlier projects financed by EU funds can be used as a basis for successful traffic management systems.
- + Public transport and commercial fleet owners benefit directly from supervising their fleets, while road administrations do not have the same economic incentive. Cooperation between these players is recommended to achieve a well-functioning system.
- + It is important to have an organisation that supports good cooperation and operation between stakeholders, who need to focus on opportunities offered by the new system instead of focusing on building and maintaining roads.
- + Different sub-systems must be able to work together when connected to a larger traffic management system. Open interfaces, open specifications and good documentation are essential variables to ensure this.

Recommendations to EC

- + Demand re-use of output from earlier projects when giving resources to new projects.
- + Support development of new methods concerning cost-benefit analysis, taking all soft parameters into account.

Cycling



About half of all car trips in cities are shorter than five kilometres. Many of these trips would be suitable for cycling. As bicycles are quiet, take up less space than cars and have no emissions, a shift from car to cycling or walking would significantly improve the traffic situation. Even a small reduction of cars during rush hour would improve traffic flow.

For longer trips, cycling can be combined with public transport. One way is to allow bicycles on-board subways and trams. Another way is to build Bike&Ride facilities close to important public transport nodes. For people to use Bike&Ride facilities, they should be sheltered and have theft-protected bicycle racks. Within Trendsetter, Graz and Lille have worked with making cycling more attractive by marketing cycling, extending the cycling network and by equipping tram and bus stops and metro stations with Bike&Ride facilities.

A shift from car driving to cycling has strong impact on emissions and energy use. Cycling measures are often relatively cheap.



Allowing bicycles on subways and trams makes bicycle an alternative also for longer trips.

Promoting cycling in Graz city centre



During a long period, Graz has gradually made the city centre safer for cycling. The work has resulted in a car free city centre, new strolling zones,

new safer junctions with main roads and 30-km/h speed limit in about 80% of the whole road network. Also, new Bike&Ride facilities have been built. The measurements have been combined with information, campaigns, organised tours, events together with professional bicycle retail shops, and lotteries for cyclists.

The strategy has increased cycling from 8% in 1982 to 14% in 2004. If all these cyclists used to go by car, the results within Trendsetter are:

- Reduced CO₂ emissions by 300 tonnes/year.
- Reduced energy use by 7 TJoule/year.

Making cycling more popular

Biking or walking keeps you fit, can save time and money and lets you travel door to door without worrying about parking. These arguments are often more successful than environmental arguments. But changes in attitude take a long time. Cities also have to change their structure in order to make bicycling more attractive. The experience from Graz and other successful bicycle cities is that an overall, long-term approach to increase safety for pedestrians and cyclists does increase the share of cyclists and results in a more attractive city. Cyclists could also be provided with good planning tools. Graz has introduced electronic route planning that helps cyclists to plan the fastest and safest bicycle trip to a destination.



Graz trains pupils to cycle

In Austria, bicycle training usually takes place in protected areas with miniature streets and traffic signs. Pupils participate before they are allowed to ride in the streets. Trendsetter helped to extend bicycle training in real traffic to all schools in Graz. Real traffic bicycle training teaches children about their rights as cyclists and traffic participants, and trains them how to cope with real traffic situations.

Graz audits bicycle policy

Graz uses Bicycle Policy Audit (BYPAD) – a method to analyse the strengths and weaknesses of a city's cycling policy. Not only are measures and results of the cycling policy considered. An even bigger concern is how the process is incorporated into political and administrative structures. With this type of broad audit, problem areas are analysed, new areas for activities and potential improvements are identified, strategic partners found and sustainable solutions developed.





Health and economy are important arguments when promoting bicycling.

Conclusions and recommendations

Cycling

- + A long-term approach to increase safety for pedestrians and cyclists is needed to increase the share of cyclists.
- + A combination of soft measures (e.g. marketing, children's education) and hard measures (e.g. B&R, bicycle lanes) is successful to increase cycling.
- + Health and safety arguments are often more successful than environmental arguments. Other arguments of more interest are that cycling saves time and money and does not require car parking space.
- + Infrastructure for cyclists should continuously be increased.
- + Sheltered and theft-protected bicycle racks, especially close to metros, commuter trains and bus stops, are effective measures.
- + Bicycle training for children should be supported. This can establish suitable travel habits for future generations.



Access restrictions for a nicer, safer and healthier city



Strolling zone in Graz favours walking and cycling, but also allows cars.



The most radical way to reduce traffic in cities is of course to forbid it. But a total ban of vehicles is not normally desirable – shops need deliveries, disabled need to be able to visit the area, residents may need to drive to their homes etc. Yet, access can be more or less restrictive. The most restrictive zones are usually rather small, or divided by streets where cars are allowed.

The following types of access restriction have been implemented in the Trendsetter cities during the project:

More restrictive

- **Car-free zones/pedestrian zones**
– motor vehicles are completely prohibited or allowed only during restricted hours, for example for deliveries in early mornings. Residents may be allowed to drive in the zone. This is implemented in Pécs.
- **Strolling zones**
– motor vehicles are allowed but broad pavements, speed regulations, physical speed regulators etc. favour walking and cycling rather than cars. This is implemented in Graz.
- **Vehicle restriction zones**
– certain vehicles are completely prohibited, e.g. heavy-duty vehicles. This is implemented in Prague and Pécs.
- **Environmental zones**
– old vehicles/vehicles with high emissions are prohibited. This is implemented in Stockholm.
- **Congestion charging**
– only vehicles that pay a fee are allowed in the zone. This will be implemented in Stockholm.
- **Zone-model parking**
– all vehicles are allowed, but the closer the central zone, the more expensive the parking. This is implemented in Pécs.

Less restrictive

Different restrictions preserves the World Heritage in Pécs

Pécs' city centre used to be heavily congested, with free parking everywhere. Today, the city core is car-free. Steps taken are:

- Introduction of a zone with limited access.
- Banning heavy-duty vehicles over 6 tonnes.
- Introduction of a 30-km/h speed limit in the whole city centre.

Pécs has also introduced a zone-model parking system with expensive parking close to the car-free zone and cheaper further from the city core. Parking revenue is used to finance free Park&Ride facilities outside the centre.



Entrance to the access restricted zone in Pécs.

In the car-free zone, private cars are banned and delivery vehicles must have permission to enter. Only residents and cars for the disabled are allowed. The police controls access and a heavy penalty makes compliance almost total. Each family living in the area receives one free permit and pays a reduced fee if they have a second car. Close relatives of elderly people can also apply for a reduced fee. Anybody can buy an annual permit, but as it is very expensive there is small demand.

Traffic-related air pollution and the noise level have decreased significantly. Fewer cars enter the city centre and parking spaces are always available. Also, many more people use public transport. The extra revenue is spent on modernisation of the fleet.

The plan is to extend the zone to the whole city centre inside the medieval city wall by 2010. An increase of green areas will complete the transformation of a more attractive city centre.

Media as source of information

In Pécs, local media – mainly television – has been engaged in the debate about the new restrictions. This has resulted in more supportive citizens. The key factor is information about the overall positive results, and not only about conflicts regarding citizens' immediate needs. Regular reports about the debates and the municipal work on parking issues have been published in the local newspaper and on local TV. The mayor and members of the city council also held regular forums together with the parking management company.

Car-free zones for more attractive cities

Car-free and strolling zones reduce emissions and noise and improve safety. With fewer cars on the streets, the number of pedestrians increases and people tend to remain in the area longer. Also, re-

stricted access with special timings for deliveries can lead to co-transportation of goods, which further reduces emissions and use of energy.

Still, a common experience from the Trendsetter cities is that a significant and often very vocal part of the citizens and shop owner are strongly against access restriction. They fear that reduced car access will lead to less business and to a decline of the area – and that this favours car-oriented external shopping centres. Evaluations in Graz show, that the fear of loss of customers is unfounded. Still, political discussions endanger access restriction decisions – therefore a strong political will is important. Once implementation starts, it is important to minimise impacts caused by the building phase and to provide information about convenient public transport and increased access for bikes and pedestrians.

Once the restrictions are implemented, evaluation shows that, in most cases, both citizens and shop owners are more satisfied than before. The area has become more attractive, with outdoor cafés and restaurants. This makes city centres livelier with more visitors. In Pécs, the average size of outdoor terraces in the area has increased by 20%. Similar results are seen in e.g. Copenhagen, where shop owners outside the car-free zone ask the city to also include their street in the zone.





With 30 km/h speed limit the traffic moves smoother while travel time for drivers does not increase.

Implement restrictions gradually

A possible way is to work step-by-step:

- Implement strolling zones and let the area adapt to more pedestrians and fewer cars.
- Make a small car-free zone.
- Finally make it into a full car-free zone.

This is the strategy in Graz, which already has widespread pedestrian zones in the city centre. Strolling zones are now installed around them. Another strategy is to establish pedestrian zones or strolling zones in peripheral district centres and around interchanges of public transport.

In Pécs, saving the World Heritage in the city centre from emissions was a strong argument that made it easier to reach public acceptance for restrictions. The municipality also officially declared that all revenue generated by the parking system will go to new parking infrastructure. In both Graz and Pécs, the zones were also refurbished to further increase the attractiveness.



Restrictions must be enforced

It is crucial for cities to control and enforce the new restrictions. The police in Stockholm started enforcing the environmental zone in 2002. Compliance was about 90% in 2001 and increased to 95% when the controls had started. Since then, compliance has been high. To keep this trend, the police must continue to control compliance and impose fines.

Smoother traffic with 30-zones

Zones with a 30 km/h speed limit can also be an efficient method. During Trendsetter, 30-zones have been implemented in the centre of Pécs, while Graz has transformed some former 50 km/h -corridors in the city's strolling zones. Recently, Stockholm has turned the whole inner city to a 30-zone. Studies show that 30-zones do not increase travel time for the driver, as traffic moves more smoothly.

Selective access restriction for heavy vehicles

Heavy-duty vehicles perform less than a tenth of the traffic movements in most European cities, but they cause almost half of the emissions of particles and NO_x. They are also responsible for most of the high noise levels. Hence they are often restricted from residential and other sensitive areas.

While Prague and Pécs are selective regarding the weight of vehicles and so steer away some of

Strolling zones in Graz

The central core in Graz is reserved for pedestrians, but bicycles are allowed and the tramway is operating six lines through the zone. Outside this area, four new strolling zones have been established. These areas used to be unsafe and unattractive with heavy traffic. Now the pavements have been broadened and roads narrowed to limit car traffic. The space reserved for pedestrians and cyclists as well as for cafés and restaurants has increased.

The pedestrian area is the core, and the new strolling zones form a second layer. Outside of this, there are roads with 30 km/h speed limit, before regular speeds apply.

Large subsurface parking garages have made it easy to drop your car outside the strolling zones.



the worst polluters from extra sensitive areas, Stockholm bans vehicles older than eight years within the whole city centre. This promotes a shift towards new and less emitting vehicles.

Acceptance is high among citizens and politicians before implementation of environmental zones, while low among transport companies. This usually changes after some time of operation, when the transport companies also become more positive. Trendsetter has shown that discussion and information are important to gain acceptance among operators. In Prague, the environmental zone rules have resulted in operators gradually shifting their fleets into smaller and more modern vehicles. New and stricter rules are now being prepared in Prague based on stricter emission limits for vehicles. In Stockholm, a reference group, including operators, prepared them well for replacing their vehicles with models that caused less pollution when the zones were implemented. This was also an efficient way to spread information to operators outside the cities.



Environmental zone in Stockholm prohibits heavy-duty diesel vehicles older than eight years.

Environmental zones

– a push for cleaner vehicles in Stockholm



The environmental zone was introduced in 1996 and prohibits heavy-duty diesel vehicles older than eight years to enter the city centre. An exception is older vehicles

that can prove that they have installed an additional exhaust after-treatment (catalysts and particulate filters). The rules are now being adapted to European emission standards.

Introduction of the zone led to a fast change to more modern, less polluting vehicles among the companies in Stockholm. Emissions of NO_x and particles have decreased, as well as the noise levels and transport energy consumption.

This type of restriction could be introduced in all European cities. It is currently implemented in the Swedish cities Stockholm, Göteborg, Malmö and Lund.

Police hunt polluters in Stockholm

The environmental zone has to be controlled and enforced. Experience from Stockholm shows that compliance can increase. In 1997, only 2.5% of vehicles inside the zone were disobeying the rules. In 1998–2000, compliance was slowly decreasing and in 2000, 10% did not follow the restrictions.

Within Trendsetter, police have been involved in a contact group, which has informed about

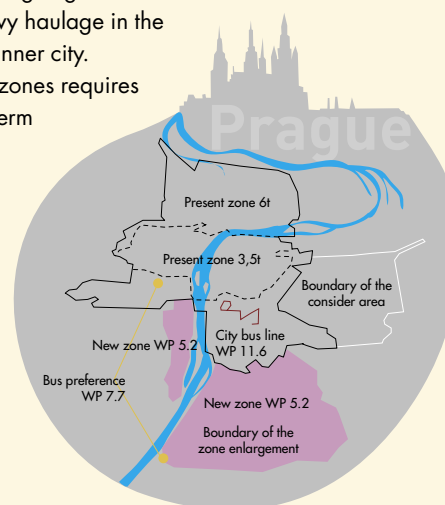
the rules. Zone compliance has been checked at the same time that the police have made other routine checks. This has changed the trend, and today fewer than 4% disobey the rules.

Stockholm also wants the government to change the legislation, to make it possible to prohibit parking for vehicles not complying with environmental zone rules. This would enable traffic wardens to fine non-compliant drivers.

No heavy duty trucks in central Prague

In Prague, access restrictions for transit traffic of heavy vehicles weighing more than 6 tonnes have been extended to new areas, and rules have become stricter in a former part of the 6 tonnes-zone, now only permitting vehicles weighing less than 3.5 tonnes. This is to curb heavy haulage in the densely populated part of the inner city.

Delivering goods within the zones requires a special permit, issued short-term or long-term (usually one year) by the municipal authorities. The permit is placed on the windscreen and is valid for both zones. Since the total area is now bigger than before, this might cause a slight increase in traffic. The total outcome, however, is a reduction of transit goods vehicles inside the new zones, reducing local emissions.





Stockholm tries congestion charging with start in January 2006.

Congestion charging

With congestion charges, only vehicles that pay a fee are allowed into a zone. By adopting a fee at just the right level, it is possible to reduce congestion and improve mobility. Fewer cars and less traffic moving smoother lead to better air quality and energy savings. Congestion charging can also make more people interested in clean vehicles if these are exempt from charges.

Traffic bottlenecks may be eliminated with congestion charging. However, without careful planning it may create new ones, for example in border areas. More public transport is also essential when congestion charging is introduced in a city centre.

In order to receive public acceptance, citizens must experience that the present situation is a problem. Strong political commitment is also needed and information and involvement by many different parties are crucial.



Stockholm tries Congestion Charging 2006

In June 2003, Stockholm City Council decided to conduct a full-scale congestion charging trial. The Swedish Parliament made the formal decision on implementation in June 2004.

The trial started in August 2005 with extended public transport. In January 2006, the congestion charges come into effect. The trial will be concluded by the end of July 2006. A referendum on permanent congestion charges will be held in conjunction with the general election on 17 September 2006. The trial aims to:

- Reduce congestion.
- Increase accessibility.
- Improve the environment.

The purpose of the trial is to test whether congestion charges can improve the traffic situation. The budget for the trials is SEK3.8 billions (€400 million), paid by the national government.

Public transport will be extended with 197 new buses and 16 new bus lines. Where possible, present bus, metro and commuter train lines will be reinforced with additional departures. To facilitate travelling, a large number of Park&Ride facilities will be built and existing ones will be made more attractive.

The congestion charging system will have a single zone boundary for the inner city of Stockholm. Registration and payment will be implemented electronically without affecting the flow of traffic. It will cost to drive into and out of the inner city on weekdays from 06.30 to 18.29, with higher charges (SEK15–20) during peak periods. The maximum charge is SEK60 per day and vehicle. There are no charges on evenings, nights, weekends or public holidays.

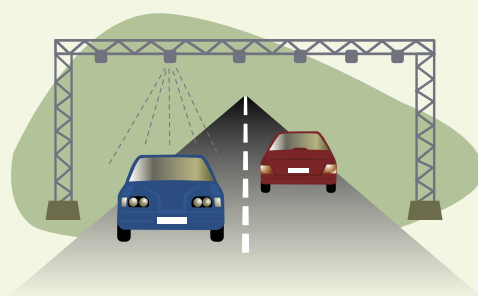
Emergency vehicles, disability and social services transportation, service vehicles and taxis will not have to pay the charges. Biofuelled vehicles (electric, ethanol and biogas) are also exempt, which has made clean vehicles more desirable.

Many decisions had to be taken at government level when planning the congestion-charging scheme and two new laws were adopted by the national parliament. The congestion charges are formally considered a federal tax.

Conclusions and recommendations

Access restriction

- + Access restrictions leads to less traffic, improved mobility and less noise, resulting in an attractive city centre with more outdoor cafés and restaurants. Less traffic also increases accessibility for the disabled, families and others, especially in strolling zones.
- + Strong political will is needed to implement access restrictions.
- + Environmental zones can be a tool for cities to fulfil the European air quality directive.
- + Acceptance is high among citizens and politicians before implementation of environmental zones, while low among transport companies. This usually changes after some time of operation, when the transport companies also become more positive.
- + Local infrastructure needs to be adjusted to the implementation of restricting zones. Drive-through corridors might be needed in certain cities depending on geography. Also, consideration is needed on how to handle long-distance and international transports.
- + Different requirements are possible within an environmental zone. If only vehicles of a certain age are allowed, renewal of the fleet will be accomplished and emissions reduced. If trucks over a certain weight are prohibited, congestion and noise decreases.
- + When restricting old and polluting vehicles, reasonable requirements should be used and the actors given time to adjust to the regulations. Information is important and stakeholders must be included. Also, changes in national legislation are often needed to implement environmental zones.
- + Compliance within the environmental zone must be controlled and enforced.
- + Citizens and shop owners normally object before implementation of car-free or strolling zones, but are most often satisfied afterwards. Very important to gain approval by politicians and citizens.
- + Public transport close to strolling zones should be increased.
- + Congestion charging reduces traffic, leads to improved mobility as well as reduced emissions and energy consumption.



- + Congestion charging should be part of a transport package with complementing measures like improved public transport and park & ride facilities.
- + Coordinate congestion charges with other environmental schemes, to gain increased efficiency. Municipal efforts to support clean vehicles can be combined with charge exceptions or reductions.
- + To achieve interoperability in the future, new congestion charging systems should be designed with consideration to international standards and good practice, if such have been developed by that time. To cooperate with other cities is necessary.
- + The timetable should be generous enough to allow bottlenecks to be eliminated in good time. Do not underestimate the time needed for this type of measure.
- + A congestion-charging scheme should be transparent and user-friendly. Citizens must experience the current traffic situation and air quality as a problem in order to support implementation of congestion charges. The main objectives should also be reflected in the system.
- + An evaluation plan should be adopted at an early stage, designed to provide accessible, comprehensive and reliable information on the efficiency of the scheme.

Recommendations to EC

- + Harmonise the standard for environmental zones in Europe. Use the Euroclass standards as a basis, as they are directly related to the emissions. Make sure that retrofitted vehicles can also meet the requirements.



Marketing attractive alternatives



People often choose mode of transport out of habit. Changing travel habits takes both an emotional approach and clear information about the advantages of sustainable alternatives. Public transport operators must develop innovative and flexible marketing initiatives to reach new passengers. Trendsetter shows some successful examples of such marketing, e.g. travel guarantee safeguarding travellers from delays in case of major traffic disturbances, and directed marketing for citizens that have recently moved into new neighbourhoods.

It is essential to identify target groups with differing needs and expectations as well as to provide information and advice on how to change travel behaviour. Within Trendsetter, such mobility management services aimed at establishing

sustainable travel habits have been applied to employees in big companies and school children.

Marketing changes attitudes

The reason for not using public transport is often unawareness of the real options and the bad reputation of public transport. Traditionally, the main task of public transport companies has been to provide good communications for citizens. Today, there is also an increasing need for marketing activities in order to keep customers and to attract more new travellers.

The Trendsetter experience is that marketing and image-strengthening activities are efficient and cheap ways to increase the number of public transport travellers. Even small and targeted actions have shown to be very successful in e.g. Stockholm and Graz.

Mobility management

Convincing citizens to change their travel habits must take their differing needs and expectations into account. Mobility management develops strategies and actions for fulfilling transport needs for individuals, institutions and companies. This can contribute to a change in awareness and education towards sustainable mobility. Mobility management could result in an efficient use of available public transport, arranging new collective transports or coordination of car-pooling. Actions directed towards companies and schools have been tried in Graz and Lille.

Local authorities need to take the lead

A common finding for all Trendsetter cities is that, irrespective of how many good alternatives to the private car you offer, you need to market them and inform citizens of their existence. People will not change their behaviour otherwise. The fact that the best travel option often includes several modes or several transport providers is a problem. Since operators may be competing, there is no clear stakeholder responsible for gathering this information and presenting it to citizens, so it will be up to the local authority to do this.

Automatic feedback keeps speed within limit

Graz has bought speed control devices, which show the drivers their current speed on displays. The evaluation shows that a speed reduction of about 10% can be achieved on average. The average speed reduction in streets with a speed limit of 30 km/h was 12%, while the speed was reduced by 9% in streets with a speed limit of 50 km/h.

An emotional approach changes attitudes in Graz

The Styrian public transport company is changing the image of public transport by promoting it as a modern and pleasant way of travelling. A series of activities not normally associated with public transport have been carried out, e.g.

- Numerous folk music bands playing at stops, in buses, trams or trains. A comprehensive programme informed passengers where and when bands performed.
- A leisure ticket, which can be used by 2 adults and 4 children for travelling Saturdays or Sundays during the summer holidays.
- TV trailers before the local Styrian news and on the radio.
- A raffle on the radio with the chance to win a ride with a group of friends in the Cabriobus (convertible bus).
- The 10-year anniversary of the public transport association, celebrated with a decorated bus, which toured Styria for two weeks and surprised passengers with orange juice or sparkling wine.

The total result is a higher awareness of the company and the services offered, a more positive attitude towards public transport and an increase in travelling, although not all activities were successful.



Direct marketing gave new passengers

As part of the initiative to "Gain 100,000 new passengers", Stockholm Transport started a direct marketing campaign, targeting new inhabitants in specific neighbourhoods. In 13 selected areas, 2,400 inhabitants received information in their mailboxes on where and when they can use public transport, a free try-out-ticket and a VIP phone number to call for personal travel planning aid. The campaign has resulted in new passengers,



Live music was part of Public transport image improving campaign in Graz.

increased revenue and goodwill. This marketing is now a part of SL's ordinary operations, aiming at reaching all 180,000 people moving into or within the Stockholm region each year.

Another target group was large companies with an environmental profile. Stockholm Transport offered a number of such companies special tickets that were beneficial for the company and the employees, e.g. non-personal tickets that could be used by everyone, or periodical tickets paid directly from employees' salaries – easy and subsidised handling due to tax reasons. Five companies took up the offer and 53% of their employees tried the special tickets.

Travel guarantee creates goodwill

In 2002, Stockholm Transport introduced a travel guarantee. If traffic disruptions cause a delay of more than 20 minutes, the affected passengers have the right to take a taxi and be compensated for the cost. The guarantee ensures passengers that they will reach their destination in time or only slightly delayed. Consequently there is an increase of passengers using public transport.

The guarantee costs SEK3–4 million/year (€300,000–400,000/year) but results in goodwill for the company and for public transport. Surveys even show that passengers who have been delayed and used the guarantee are more satisfied with the public transport than passengers who have not experienced any delay.

Lille Metropole sets the example for private companies

Lille Metropole has implemented a mobility plan for its 2,200 employees. There is a fleet of cars, scooters and bicycles for employees to use on both work and leisure trips and a system for commuters to carpool (three groups so far).

Lille also promotes cycling for its employees by building secure bicycle racks and improving pedestrian and bicycle routes to the city hall. The internal mobility plan has resulted in 15% more employees cycling. This number is expected to rise even more.

By subsidising half the cost of a season ticket, the use of public transport has also increased and 11% of the employees use this option.

Company mobility plans are now adopted by many other organisations and private companies in the region.

Offering companies mobility management in Graz

Two companies in Graz were contacted to get special advice on alternative modes of travel to and from work. The city offered the employees individual help at work with planning their daily commute and informed about Park&Ride and Bike&Ride facilities.

Newly hired staff may need to change travel habits and are more likely to adopt new ways of travelling. A special mobility package was designed for them, including a map and timetable of the public transport net, public transport stops and points of interest in the company surroundings, a cycle map, etc.

During the project, the city reinforced the parking regulations in the companies' surroundings, which was a further incentive to switch from car to other modes.



Helping young people to develop good travel habits will influence future travel patterns.

Companies can influence travel behaviour

Large companies cause a lot of traffic when their employees commute to and from work. Since commuters have the same destination and similar working hours they are relatively easy to approach and can be informed and motivated at their workplace. This increases the chance of success of mobility management in companies.

Big companies have the resources for car-sharing and carpooling. However, companies normally do not regard journeys to and from work as a company responsibility. By setting good examples, like Lille Metropole, or by offering free advice as in Graz, companies can become aware of their opportunities to influence travel behaviour. It is also shown that company measures work well in combination with an extension of paid parking or limited access zones. High financial incentives for commuters driving their cars to work constrain the ambitions of mobility management.

The work with two companies in Graz shows that personal engagement of a single person in the company can make the whole difference whether a company is taking transport issues seriously or not.

Schools

Starting with the young is often a good idea. Lessons learnt as a child often affect travel habits in the future. Furthermore, when children are aware of good and bad habits, parents may change their own habits while trying to set good examples for their children.



Events

Big events like festivals and fairs attract many people, not only from the city but also from other parts of the nation or from abroad. Many come by car or sometimes in organised buses, causing congestion, emissions and trouble for the residents in the surrounding areas. Handling transport and logistics smoothly on these occasions takes much effort, and there should be a large potential for shifting to other modes. In Graz, an event ticket includes free journeys with public transport to and from the event.



Pupils teach their parents

Awareness-raising activities were undertaken at four schools in Graz with the aim to influence pupils, as well as parents and teachers.

Activities:

- Carpooling within the school classes with an electronic system that makes it easy to form carpools.
- Analysis of the school neighbourhood with respect to traffic safety aspects together with the police.
- Collecting "green miles" while walking or biking to school.
- Car-free month with the "kugelbarometer": a measure device, where the children each morning throw coloured balls (each mode a different colour) into different transparent boxes, to indicate the different transport modes.
- Painting the streets, measuring speed, etc.
- A benchmarking tool available on www.schoolway.net served to define specific measures per school.

In addition, teachers, police and parent representatives met in steering committees once a year to create a school environment that enhances sustainable mobility.

Sustainable journeys to events

Graz interviewed visitors to different events and analysed how people could become more interested in using other modes of transportation. The events included a fair, pop concert, folk music concert, a medical congress and a high school dance.

The entrance fee included free public transport to and from the events. Approximately 40% claimed to be aware of this offer.

Only 15% of car users even considered using public transport. They had chosen the car because they did not know how to reach the events by public transport or found the car more convenient with respect to comfort and timetables.

The conclusion is that event organisers should be involved. Close and regular cooperation between organiser, public transport and the city could lead to integrated marketing of the event and how to get there. The good offer of public transport may be accompanied by restrictions for private cars. As many visitors of events come from abroad, the specific traffic situation has to be described when promoting the event. A good example in Graz is the fair event, which is already known for partly transforming the access highway into a parking strip provided with a shuttle service.

Conclusions and recommendations

Marketing attractive alternatives

- + Communication, information and marketing are important when trying to increase travel with public transport and other modes of sustainable transport. It takes time to change peoples' behaviour. Soft measures are cheap and efficient, especially when combined with infrastructure investments.
- + Information on services and free trials are successful ways to obtain new customers. New residents are a priority target group.
- + Mobility management can be a tool for changing travel patterns. School mobility management helps raise awareness among parents and teachers.
- + Companies do not regard journeys to and from work as a company responsibility. Measures work well in combination with an extension of paid parking or limited access zones.
- + By setting own examples, city administrations can convince companies to take part in mobility management.
- + High financial incentives for commuters driving their cars to work constrain the ambitions of mobility management. Do not set up car user-friendly framework conditions, which support car usage.

Recommendations to EC

- + Make mobility plans mandatory for companies over a certain size.

Improved goods distribution



Co-transportation of goods to shops, restaurants and construction sites can dramatically reduce the number of delivery vehicles. This is shown within three Trendsetter projects in Stockholm and Graz. Fewer delivery vehicles result in less emissions, noise and street clogging.

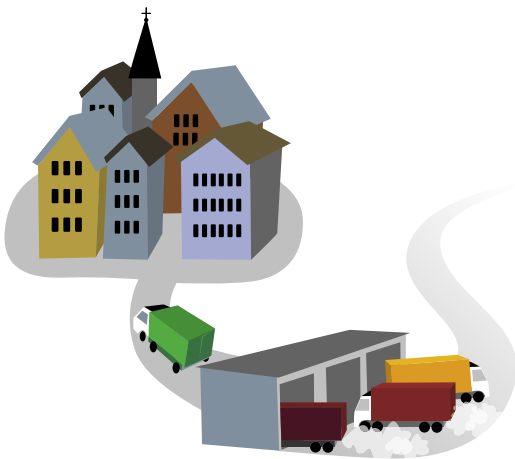
So far, this type of goods distribution is not very common. However, cities could create a demand for more coordinated logistics. This is done through information, coordination of schemes, initial funding and other assistance to participants.

Hesitant parties could be convinced if the new transport solutions also offer other benefits, e.g. storing facilities, packing/unpacking of goods, hanging of clothes and price tagging.

Living and working in inner-city areas where streets, squares and pavements are often packed with delivery trucks and vans can be frustrating. Not only are the vehicles in the way, they also cause noise and bad air. More than half of the emissions in many European cities come from heavy transports, which increase faster than private car transports.

A challenge for cities is the new distribution patterns caused by information technology. Today, customers can search worldwide for the cheapest merchandise. Besides the price, suppliers compete with fast and just-in-time deliveries. Customers adapt their buying habits to also ordering just-in-time. The result is longer, less coordinated and more frequent transports, which are negative for the environment and more expensive for the delivery companies. Also, a growing number of Internet shoppers may lead to more deliveries, even if private car trips for shopping are avoided. In many European cities, the volume of goods traffic has increased significantly the last decade, especially in new EU member states with high economic growth.

The problem is most often not the larger transport companies, but the smaller suppliers. The larger companies usually have efficient daily routes within restricted delivery hours and fill their vehicles. It is the smaller delivery vans and haulier companies with only partly loaded trucks that clog the shopping areas in big cities. But there are ways to reduce the need for many of these deliveries.





Consolidation reduces transports

Imagine that half-empty trucks and small delivery vans from different suppliers reload their goods and co-transport them to the customer. A better load rate and more efficient distribution would mean fewer vehicles in the city and thereby better living and working conditions. Visitors and businesses would also benefit from less jammed streets.

A key solution to consolidating goods in this manner is establishing logistics centres. Trendsetter projects show how logistics centres for well-defined areas with evident logistics problems, such as the narrow streets of old European cities, can be successful.

Logistics centres in Graz and Stockholm

A shopping mall in Graz, a construction site in Stockholm and the Old Medieval Town in Stockholm had problems with heavy traffic congestion. When logistics centres were established, congestion was reduced. In both cities, the logistics centres have systems for planned distribution with less polluting and fully loaded vehicles. With fewer, shorter and cleaner transport trips, energy use, emissions and noise have decreased while mobility has improved.

In Graz, a new logistics company was founded when a big department store needed a new transport solution for large indoor construction work.

The company interlinks trade, logistics, services, freight companies, commerce and industry in order to offer freight customers more than just deliveries.

The logistics centre in Hammarby Sjöstad in Stockholm offers terminal and delivery services for incoming deliveries to a very large construction area. At the entrance, all goods are unloaded and delivered more efficiently or stored for later just-in-time delivery.

In the Old Medieval Town of Stockholm, “O-centralen” was set up nearby. The logistics centre offers shops and restaurants co-transportation of goods with small clean vehicles.

In all three examples, distribution would be even more efficient if other vehicles would have restricted access to the delivery areas.

Planning a key factor

What is a good location for a logistics centre and what size should the delivery area have? These are two important factors to consider when planning for a successful scheme.

In Hammarby Sjöstad, the delivery area is naturally delimited as it is a construction site. The logistic centre has been set up on the border of the area, which is a natural position. Locating it somewhere further away or in the middle of the area would only create unnecessary problems.





Co-transportation of food in Old Town of Stockholm is an expanding business.

Less emissions in the Old Town

Shops and restaurants in the Old Town of Stockholm are located on small and very narrow streets. Heavy distribution traffic not only causes pollution that erodes the medieval buildings. Traffic also causes vibrations that shake and destroy this sensitive area.

In order to improve goods distribution, a logistics centre where suppliers can unload their goods was set up just outside the Old Town. A delivery service company, Home 2 You, reloads and deliver them with small biogas-fuelled vehicles.

As a result, negative effects of distribution traffic, e.g. emissions, noise and congestion, have been reduced. The average number of deliveries to each customer is down from six to only one delivery per day.

This has:

- Reduced the number of trips from 120,000 to 117,000.
- Increased the delivery vehicle load rate from 67% to 80%.

The results will grow considerably as more restaurants join the scheme.



Electric van co-transport deliveries in the inner city of Graz.

Co-transportation of goods to shopping mall in Graz

In Graz, necessity was the moving power for the creation of a new logistic system for daily goods distribution to a department store. Transports had to be consolidated to avoid chaos on the narrow streets when a five-level garage was being built beneath Kastner & Öhler, the city's largest shopping centre. Deliveries to the shopping centre were coordinated and then co-transported by low emission vehicles from an external warehouse at the southern city border. This has:

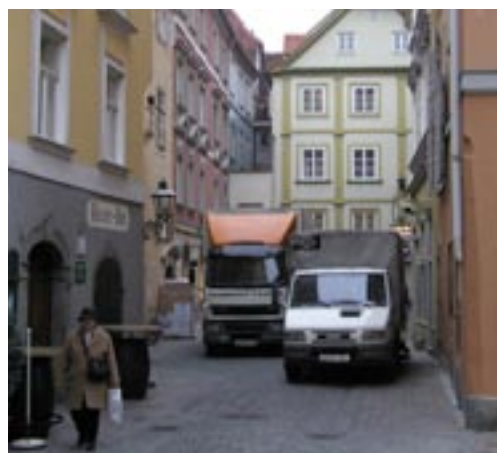
- Reduced the number of trips from 2,000 to 1,100 in the area around the department store.
- Reduced vehicle kilometres from 80 to 45 km.
- Reduced vehicle fleet from four to two vehicles.

O-centralen is also well situated, 500 meters from the Old Town, and close to the main deliverers' storage area. This makes deliveries to O-centralen easier and keeps the re-loading of goods out of the sensitive area.

In Graz, it was more natural to put the logistics centre at the border of the city near a highway. This way, large vehicles avoid having to drive into the city centre and emissions are kept away from the city centre.

Analysis of regulations important

When planning a logistics centre, it is crucial to find out what laws, regulations and administrative routines might contravene the project. For example, in the Old Town project in Stockholm, mixed deliveries to shops and restaurants are not permitted from the same logistic centre without special arrangements. The Environment and Health Administration demanded a rebuilding of the premises, which caused extra costs and delayed the project.



Creating a demand for consolidation

Goods consolidation is still uncommon, even though most players would gain from it. One reason is that no person or organisation is responsible for coordinating the actions. Another reason is that suppliers lose direct contact with their customers through the driver, and that they prefer to have their own cars with logotypes. There are also no complete systems to join.

One of the big barriers in the projects in Graz and Stockholm has also been the lack of customer demand and involvement. Owners of shops and restaurants generally lack knowledge about logistics as they mostly receive their goods free of charge. The real transport costs are hidden and the suppliers have no interest in changing their system.

Cities need to take the lead

To make things happen, local authorities have to take action. Cities need to inform potential stakeholders about the possibilities and effects, coordinate the consolidation schemes and help contractors with administrative and legal issues. Political support is also important, since funding is needed in the beginning. Motivation among participants could also increase with positive incentives, e.g. access to bus lanes or better unloading services.

Awareness campaigns might be a solution to encourage the public to ask for specifications of transport costs. Similar campaigns from the European Commission to the cities in Europe could increase the knowledge of logistics and environmental issues, which could boost the interest in new forms of goods distribution.

Co-transportation of construction material in Stockholm also reduced damage and theft due to safe storing.



Market players as role models

Large transport companies, like DHL, Schenker and UPS, are market players who could serve as role models. They are experienced at logistics and could encourage smaller companies to become interested in co-transported deliveries by initiating logistic centres together with customers within a specific area.

At airports, transport companies and the owner of the airport or the shopping mall could agree on a new logistics system. This is done at Heathrow Airport, where the airport company BAA has a contract with Exel Logistics for a retail consolidation centre.

Trendsetter experiences

The Trendsetter projects clearly show that it is necessary to gather all interested stakeholders in the logistics chain to find coordinated solutions. All players need to feel that the solution is favourable for them.

Also, projects and full scale operations only work when there is a delimited distribution area, a driving force and a willingness to pay for the project. To be “self-funded” the project has to gather enough participants. There also has to be a clear political interest, to reduce the time spent on decision-making.

Clean and efficient deliveries in Hammarby Sjöstad

Hammarby Sjöstad is a former harbour area and a new part of central Stockholm. Several thousand apartments are being built on this huge construction site, which at the same time is a residential area. If too many different deliveries were allowed onto the site, inhabitants and construction workers would face impossible conditions.

Therefore, a logistics centre was established in 2001. Until 2004, 400 deliveries, or roughly 700 tonnes of construction material, arrived daily. Small deliveries were unloaded and coordinated at the centre and then delivered to 22 unloading zones.

Larger deliveries were unloaded and stored at the centre before being delivered “just-in-time” – thus ensuring that only full trucks entered the area. This also substantially decreased the risk of theft and sabotage. All vehicles used for deliveries within the site were of the highest environmental standard (Euro IV).

Overall effects are less congestion and better living-conditions. The logistics centre has also helped ensure the timetable of the project. In more detail, the project has:

- Reduced the number of direct small deliveries to the site by approximately 80%.
- Increased the delivery vehicle load rate from approximately 50% to 85%.

Extra services for increased motivation

Long-term, most participants would probably gain some kind of profit from co-transportation, such as fewer deliveries and less need for extra personnel, more attractive surroundings, and a possibility for the suppliers to lower their prices thanks to lower transport costs. The forwarders save money when the number of vehicles is reduced.

The new transport solutions could also offer additional benefits in order to convince suppliers and customers to participate. They could, for example, store goods, pack and unpack merchandise, hang clothes and offer price tagging at the logistics centre. The customers could be charged for these extra services, but should not have to pay extra for the consolidation of goods.

Safe storage appreciated service

At the logistics centre in Hammarby Sjöstad, customers can store their supplies indoors, which has led to less theft and sabotage. An evaluation shows that many customers greatly appreciate this opportunity.

Storage facilities are also helpful for retailers in cities, since they often have a very limited storage capacity and therefore frequently order supplies and deliveries. This could be avoided with storage services at a logistics centre, and sequenced, co-transported deliveries.



More lessons learnt

Cooperation within cities

In order for a logistics centre to function smoothly, different departments in the city have to cooperate well. This was the case in the Old Town in Stockholm, where restricted delivery hours caused problems. When additional restaurants joined the consolidation scheme, all goods could not be delivered within the restricted hours. Finally the traffic department extended the time frame for the biogas vehicle from the logistics centre.

Starting small-scale best practice

A good way of creating a new distribution solution is to start on a small-scale. It is easier to market the service and get other parties interested when a system is in operation and proven efficient. Graz is a good example. The consolidation of retail goods started with only two partners, the forwarder ITG and the Kastner & Öhler shopping centre. The project then expanded step-by-step to involve additional stakeholders.

Privately funded centres more successful

Results show that privately funded logistics centres tend to be more successful than centres with public funding. They are also more likely to continue after the pilot project or to start out as a full-scale scheme from the beginning. In Graz, a large department store took the initiative and is still the driver of the logistics solution. In Stockholm, Home 2 You, the company that runs the logistics centre in the Old Town, has been the driver.





Gaining goodwill short-term, profit long-term

It is difficult for small and medium-sized enterprises such as Home 2 You to take large financial risks or make large investments. But Home 2 You has a general interest in being a part of tomorrow's logistics and market. The project in the Old Town has resulted in goodwill, new customers, good marketing, and will mean profit in the long run. Initially, though, there was a need for public funding for parts of the investments as well as support from the City of Stockholm.

Price adjustments to cover costs

In the beginning, the system in Hammarby Sjöstad was sponsored by the City of Stockholm. However, when clients gradually discovered the extra services at the logistics centre and realised that they could save money using them, prices for the services could be increased. By the end of the project, income and expenses were equal. The major part of the income came from temporary material storage and extra services, such as just-in-time delivery, partial deliveries and goods delivered by crane into the building. The delivery companies were the big winners in Hammarby Sjöstad, since the contractors did not charge them for costs related to the logistics centre.

Conclusions and recommendations

Improved goods distribution

- + Visitors and citizens experience improved mobility, safer traffic situation, less emissions and less noise when deliveries are co-transported. Restaurants and shops also gain from it.
- + Long-term benefits for participants are fewer deliveries, more attractive surroundings, a possibility for suppliers to lower their prices due to lower transport cost, etc.
- + The right location for a logistics centre differs from city to city, but the area should be well defined and have evident problems.
- + Cities need to take the lead and inform, coordinate schemes, provide initial funding and offer assistance with administrative and legal issues, etc.
- + Extra services, e.g. storing facilities, deliveries on time, packing/unpacking of goods, hanging of clothes and price tagging can increase the benefits from the scheme.
- + At least one strong actor should preferably be involved, to serve as a good example. The project can be increased step-by-step by attracting additional actors when benefits have been shown.
- + Positive incentives could be used, like better loading zones, access to bus lanes, reduced costs and extended delivery hours.
- + Initial funding is often needed to overcome initial resistance.
- + Positive effects increase when different departments in the city cooperate well.

Clean vehicles

– a way to reduce emissions



Alternative fuels work perfectly for city bus and car fleets. This is shown in three Trendsetter cities, where clean vehicles have been promoted. The public bus fleets in Graz, Lille and central Stockholm run on renewable fuels. In addition, a whole taxi fleet in Graz and more than 3,000 private vehicles in Stockholm are now clean.

The projects have inspired car manufacturers, private companies and citizens. They have also led to better acceptance for and distribution of biofuels, a reduction of emissions and less noise in the city centres. Clean vehicles are a cost-effective way to reduce emissions and greenhouse gases.

Promotion of clean vehicles requires work on several levels. Crucial for success are ambitious cities and long-term commitment among local authorities. By gathering many buyers in joint procurements, cities can promote the development of clean vehicles. Another way is by creating incentives for companies and private citizens as compensation for the somewhat higher clean vehicle costs.



Cellulose is a promising future feed stock for biofuel production.

If more people would choose public transportation and all goods were co-transported, the cities would have much less traffic. Trendsetter projects aim at such development, but there will always be a need for buses, delivery vehicles, taxis and private cars. These vehicles, however, need to operate on biofuels that do not emit greenhouse gases or other pollutants – they need to be clean. Otherwise, such traffic contributes heavily to greenhouse gas emissions air pollution.



Directive sets goals for greenhouse gases

The European Commission seeks to raise the use of biofuels in the EU through its Biofuels Directive. A background to the directive is the Kyoto Protocol, which states that the EU should reduce its greenhouse gas emissions by 8% until 2010. The directive sets a goal for the member states, and demands yearly progress reports to the Commission. However, there are no sanctions if a state fails to fulfil its obligations, which makes the directive rather toothless. It also leaves European cities without the necessary support from the Commission to persuade national governments to introduce incentives such as tax reduction or investment support for biofuel production.



The EU Biofuels Directive

The EU directive on the promotion of biofuels (2003/30/EC) contains targets for the substitution of fossil fuels (petrol and diesel). The reference level for these targets was set to 2% in 2005 and 5.75% in 2010. The European Commission has also suggested a goal of 20% alternative motor fuels by 2020.

The member states must set their own targets. But in autumn 2005 only a few states had set the target at 2% for 2005 and no country had set a target for 2010.

Fuels



Biodiesel, biogas and ethanol are the main bio-fuels currently available. They are technologically mature and available in sufficient amounts. All three fuels work well both for city bus fleets and for cars. This is shown in the Trendsetter cities, which to some extent also have worked with electric and electric hybrid vehicles.



Biodiesel



Biodiesel taxi

Biodiesel is a renewable fuel for diesel engines that can be derived from different vegetable oils. The most common sources in Europe are rapeseed oil and sunflower oil. The present European biodiesel production of 1.9 million tonnes (2004) could serve 2 million cars. France, Germany, Italy and Austria are the largest producers of biodiesel in Europe.

There are several advantages with biodiesel:

- It reduces fossil CO₂ emissions by 50–80%. The size of the reduction depends on how the original vegetable oil is produced.
- It emits no sulphur, which is especially good for countries using diesel with high sulphur content.
- Biodiesel generates up to 50% less particulate matter than fossil diesel, if buses are equipped with particle catalysts. Without any catalyst, biodiesel and fossil diesel emit similar amounts of particles.
- Biodiesel can be produced locally, with means less transports and reduced emissions. In Graz, biodiesel is mainly made from rapeseed by a local farmers' cooperative and used cooking oil.

A disadvantage with biodiesel is that the NO_x emissions are higher than from fossil diesel, approximately up to 20% higher. Catalysts have little effect on the NO_x emissions. The higher NO_x emissions may be a problem in cities that suffer from too much air pollution. When used as a low blend in fossil diesel, though, the increase of NO_x is rather small.

Biodiesel is used in many European countries, though mostly as a low-blend in fossil diesel.

From the frying pan into the tank in Graz

In Graz, most biodiesel is made from rapeseed oil, but used cooking oil is also converted into biodiesel. This reduces the emissions of fossil CO₂ even further and helps solve a disposal problem, as the frying oil otherwise puts strain on the sewage treatment plant. The University of Graz and Bio Diesel International (BDI) developed the technology for the conversion.

More than 250 restaurants have their used oil collected each month. The city partly finances this process. The oil is transported to the biodiesel plant outside Graz where it is filtered/purified and injected in the ordinary production line. Restaurants save about €0.30/kg oil by not having to pay the disposal fee. Graz also collects used cooking oil from households.

In 2003, 180 tonnes of used cooking oil were collected from restaurants and 80 tonnes from private households. When converted this gives enough biodiesel to run 26 buses.

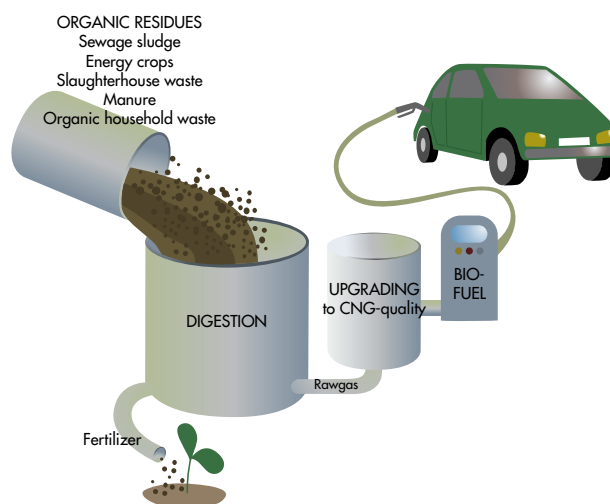




Most diesel vehicles available in Europe can operate on the blended fuel. Pure biodiesel can be used directly in many modern diesel vehicles, but older ones need to change some hoses and gaskets. A biodiesel car can be fuelled with ordinary diesel in case biodiesel is not available.

Biogas

Biogas is the cleanest vehicle fuel that is commercially available. There are almost no health hazardous emissions and very little greenhouse gas emissions. Biogas vehicles are also less noisy than diesel vehicles. This makes biogas especially suitable for buses and waste collection vehicles. The disadvantage is that such heavy-duty biogas vehicles use more energy than the diesel equivalent, especially at low speeds. At least part of the increased energy consumption can be reduced, by using less powerful engines and by educating the drivers. When used in conventional petrol cars, however, biogas is as energy efficient as petrol.

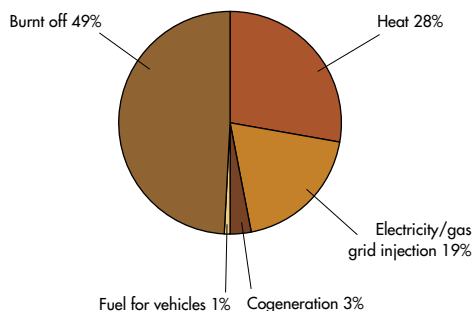


Using biogas as a fuel is also a constructive action towards waste management problems. Biogas is produced naturally when organic waste ferments and is an explosive and very strong greenhouse gas – 23 times more potent than CO₂. Therefore, approximately 50% of the biogas is burnt or flared in waste treatment plants. The rest is frequently used to generate heat and electricity. Currently, only Sweden, France and Switzerland use biogas for transport.

In plants dedicated for biogas production, the process can be controlled and the output ratio increased. All types of organic material work as input; restaurant waste, offal from slaughterhouses, surplus grain, wood etc.

Before being used as a fuel, biogas must be purified. This requires big investments, but Lille has shown that a bus fleet operating on biogas costs no more than operating diesel buses. After an initial learning period, Stockholm also shows good

Biogas use in Europe



Source: Biogas Barometer December 2002



Volvo V70 Bifuel

economy, with only slightly higher costs than for diesel buses. Within a couple of years, the cost for biogas in Stockholm is expected to be lower than for diesel. City fleets are suitable for biogas as the gas is normally available from water treatment or organic waste plants in cities. No extensive general fuelling infrastructure is necessary when biogas is introduced in municipal fleets.

Buses, waste collection vehicles, transporters, cars, vans and lorries operating on biogas are already available on the market. The fleet in Europe is currently about 3,000. Most biogas cars also have a petrol tank so that they can operate while the fuelling infrastructure is developing. The potential for biogas in Europe is that approximately up to 20% of all fuel used for road transportation could be substituted with biogas.

Biogas versus natural gas

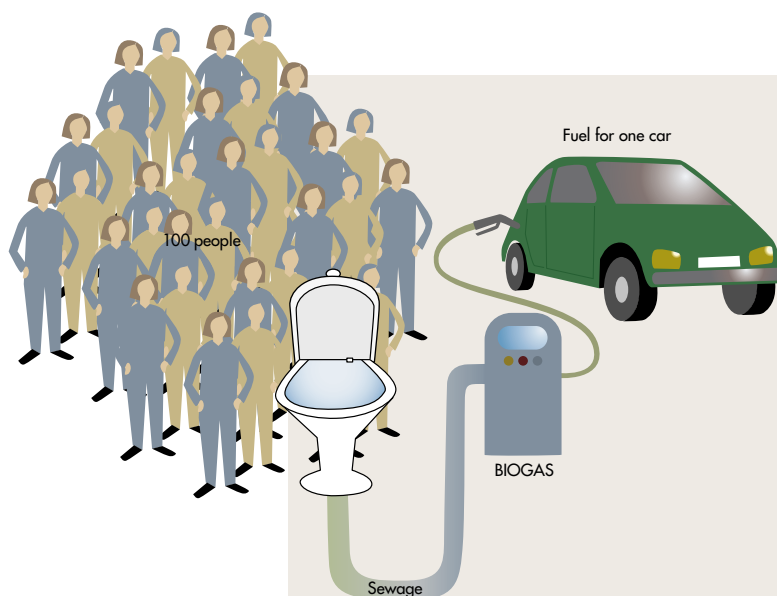
What advantages does biogas have over natural gas? After all, both are basically methane gas and both fuels radically reduce the emissions of health hazardous gases. The same infrastructure can be used by both biogas and natural gas. Neither of the fuels is more energy-efficient than diesel when used in buses. Still, the main difference is that natural gas is a finite resource while biogas is renewable and does not contribute to the climate effect.

Ethanol

Ethanol is the most common vehicle biofuel in the world today – more than 6 million cars drive on ethanol, most of them in Brazil and in the US. Ethanol has the potential to become the dominating fuel globally for the next 15 years according to the OECD/IEA. The current global production capacity could serve almost 15 million cars, but has a potential to serve 80 million cars by 2020. The largest producers in Europe are France, Spain and Sweden.

Ethanol is an alcohol produced from organic materials and used in modified engines. It contributes less CO₂-emissions and health hazardous emissions than petrol and diesel. Ethanol is mainly produced from agricultural crops, such as sugar beet, sugar cane, wheat and corn, which can be locally produced. Cellulose is a promising feedstock that could be commercially available after 2010. As ethanol is liquid, the existent fuelling infrastructure can be used with only small adaptations.

Normally, ethanol is blended with 15% petrol to avoid starting problems at cold temperatures. With 85% ethanol, the fuel is known as E85. Currently, all ethanol cars are flexi-fuel and can operate on either E85 or petrol, or mixtures of them. A computer senses the fuel in the tank and adapts the engine. The benefit is that flexi-fuel cars can be used without any restriction until there are enough ethanol filling stations.



Local biogas from waste material in Lille

In November 2004, Lille started building a biogas plant that will fuel half of the city's bus fleet. A pilot production by the city's water treatment plant paved the way for the construction, al-

though it took time to convince decision makers of this new technology even if the economic viability of the project is well demonstrated. The plant will be finished in 2006 and uses organic waste from the city and the neighbouring area. The production of 3.6 million m³ biogas will be led through a short pipeline to a neighbouring gas-bus depot. Since biogas production varies, a dual feeding system allows both biogas and natural gas to fuel the buses.

From toilet to tank in Stockholm

Since 1996, Stockholm uses biogas from sewage (toilet water) for transport. In 2005, the second plant opened at the water treatment. It feeds a bus depot and a commercial fuelling station with biogas through a pipeline. The present production can operate 130 inner city buses and about 1,000 cars and vans. Stockholm also performs a study on how to collect restaurant and household waste and feed it into the water treatment plant, thus increasing the amount of biogas.



Agricultural crops and waste products are feed stocks for production of bio-diesel, bioethanol and sometimes also for biogas.

Existing ethanol buses have diesel engines and run on E95 with an added ignition improver. Sweden is the only country in the world that uses ethanol for both buses and cars. 80% of clean vehicles in Sweden run on ethanol.

Ethanol is also blended in petrol. For example, Sweden blends 5% in all 95 octane petrol while many states in the US blend 10%. Most regular petrol in Brazil contains 20–25% ethanol. In Spain, Italy and France a chemical compound deriving from ethanol (ETBE) is blended into petrol to decrease the emissions of CO and HC.

Lack of standard for ethanol vehicles

Despite the potential of ethanol and the convenient flexi-fuel system, there are only a few vehicle models available on the European market today. One problem when promoting ethanol vehicles is that there is currently no standard for them or for ethanol fuel. Ethanol vehicles are type-approved as petrol cars, which causes problems when giving benefits for clean vehicles. Still, there is some development, and both Volvo and Saab launched ethanol-fuelled vehicles in Sweden 2005, aiming also at the European market.

Electric and electric-hybrid vehicles

Electric vehicles could also be regarded as clean, provided that they use electricity from renewable sources. However, the battery technology is not sufficiently developed for widespread use of electric vehicles – they have a short range and long re-charging time. Thus they have limited use, e.g. indoor vehicles, cars that drive very short distances, and some two-wheelers.

Current electric-hybrid vehicles run on fossil fuel, which charges the battery to power the electric motor. The battery also stores surplus energy, e.g. when braking. It is also possible to use only the electric motor for short periods. This reduces the fuel consumption by up to 40%. There are a few electric-hybrid cars commercially available, and so far only pilot examples of buses and trucks, but using the technology in bio-fuelled vehicles will be highly useful in a clean vehicle society.



Ford Focus FFV



Development of the clean vehicle society



Graz has substituted the entire city bus fleet to biodiesel buses.

Big changes are needed if we want to achieve a clean vehicle society. We need new fuel production and distribution, new or adjusted vehicles and a maintenance chain. These changes do not occur by themselves but call for a strong and dedicated leadership.

Public authorities are key stakeholders in this development, as they can offer incentives and disincentives that accelerate the uptake of clean vehicles. They can also act with a long-term perspective. Although emissions of greenhouse gases are a global problem, and some incentives such as tax reduction are best implemented at the national or EU level, the use of clean vehicles can be highly influenced by proactive local authorities.

Local authorities have a special responsibility to start the development of a clean vehicle society as they:

- are responsible for the air quality,
- operate bus fleets for public transport and large fleets of municipal vehicles,
- buy large quantities of fuel,
- can kick-off the introduction by turning their own fleet clean,
- have the power to decide on different incentives such as parking discounts, special parking areas, special priority for clean taxis etc,
- have the means to reach citizens with information,
- are in charge of spatial planning and can put requirements on fuelling stations to provide biofuels,
- buy large amounts of transport services and can thus require the use of clean vehicles in tenders.

Trendsetter has shown that this work requires extensive cooperation, an ambitious and strong political leadership and an overall perspective. One example is the economic situation for a Swedish water company producing biogas. It is less economical for the company to sell the biogas as a fuel than to use it to heat the plant, due to the costly purification needed for biogas fuel. The benefits, however, of a cheap fuel and the reduced emissions from the biogas buses compared to diesel must be included in the calculation.

Local leadership spurs national results

Since 1995, the City of Stockholm has a special programme for introducing clean vehicles and fuels. A group called Clean Vehicles in Stockholm at the Environment and Health Administration runs it. Members from all political parties form a committee that supervises the group. Politicians actively try to harmonise the cities' different actions in order to support the market introduction of clean vehicles and fuels. Together with their colleagues in Göteborg and Malmö, also running clean vehicle projects, they regularly discuss this issues with the national government. This has resulted in tax reductions on clean fuels and vehicles. Sales increase by 50% each year and the forecast is that 8–10% of sales are clean vehicles in 2006. Also, the national government is about to introduce clean vehicles in their own fleet, following the examples of these cities.

Public heavy-duty vehicles



Waste collection with biogas freighters.

Buses, trucks and other heavy-duty vehicles operate well on alternative fuels. Within Trendsetter, biogas buses have been introduced in both Lille and Stockholm. In Graz, the entire public bus fleet is driven on biodiesel. Waste collection trucks with biogas fuel have been a success in the Old Town of Stockholm – both drivers and citizens appreciate cleaner air and lower noise levels. Stockholm has also been operating the inner city bus fleet of 250 buses on ethanol for 18 years.

However, there are few other types of clean heavy vehicles on the market, which is an obstacle for the cities.

Higher costs – or lower?

The price situation could be a reason for the slow development. The direct cost for buying and operating clean heavy-duty vehicles is in many cases higher than for a conventional diesel vehicle. A biogas bus or lorry costs €30,000–50,000 more, an ethanol bus costs €10,000 more while a biodiesel bus costs almost the same as an ordinary diesel bus.

The running and maintenance costs are also somewhat higher. The fuel cost varies between fuels and also depends on taxes in the different countries, but are normally slightly higher than for diesel. The Stockholm Public Transport Authority estimates 2% higher costs per year for the ethanol buses. This includes the higher bus price, more frequent maintenance and the higher fuel consumption.

However, compared with other ways of reducing emissions and noise, the costs for operating clean vehicles are low. Several future trends and regulations will also change the cost relation between biofuels and diesel:

- Oil price is rising.
- New emission standards will raise the price for diesel vehicles.
- With more and more clean vehicle users, economy of scale will lower the price of both biofuels and clean vehicles.

Already, Lille has shown that it is possible to produce biogas at a price that gives a total cost per

km equal to diesel. Stockholm still shows slightly higher total costs than for diesel vehicles, but the costs are decreasing, while the costs for diesel buses are increasing. And in Austria, where there is no tax on biodiesel, ordinary diesel actually costs 7% more, which makes the total cost for operating biodiesel heavy vehicles lower than for fossil fuel buses.



Only biodiesel buses in Graz

The public transport company in Graz has switched the whole bus fleet from diesel to biodiesel. This was done by making sure that new buses can operate on biodiesel and by converting existing buses. There was a small extra cost for biodiesel buses but actual savings in operating costs.

In 2004, all biodiesel buses were also equipped with a particle converter that reduces emissions of particles by 90% compared to diesel buses. This has saved 4,800 tonnes of fossil CO₂ and 3,220 kg particles per year.

An innovative leasing model for tramways and buses, including maintenance, would have allowed for a quicker renewal of the fleet, but financial restrictions put a stop to this model.



Inner-city buses in Stockholm are running solely on renewables: bioethanol and biogas.

Inner-city buses in Stockholm fully on renewables

Today, 2,000 buses are operated in the public transport system. The public transport company's goal is that all buses shall be clean by 2030. In 2002, there were 250 ethanol buses in operation and by the end of 2008 there will be another 123. Furthermore, within Trendsetter, 21 biogas buses have been introduced and as a result, Stockholm Transport will buy a total of 130 biogas buses in the next years. Some of these have already been ordered.

Already the 21 Trendsetter buses have resulted in:

- Reduced fossil CO₂ emissions by 1,900 tonnes/year.
- A large noise reduction.
- More than 90% satisfied or very satisfied drivers, a majority of whom would recommend driving biogas fuelled heavy vehicles to others.
- Increased fuel consumption by 4,400,000 MJ/year, but from renewable energy. This is because gas engines consume more fuel than diesel engines, especially when running at very low gear. Educating the drivers on how to drive gas vehicles can counteract this.
- Higher maintenance costs, but it is too early to say how large this increase is. However, this is balanced by a low fuel price.

Nine biogas-fuelled waste collection vehicles have also been in use, resulting in the same advantages and driver satisfaction as for biogas buses. The fuel consumption has been somewhat lower than for the buses, but still 20–50% higher (on energy basis) compared to ordinary diesel vehicles. The drivers consider the biogas trucks to be less noisy and smelly, but rate acceleration and range as inferior compared with diesel trucks. The positive experience from Trendsetter has resulted in additional orders of 22 biogas refuse trucks, and more are expected.

Lille gradually shifts to gas buses

Within Trendsetter, Lille Metropole has continued to substitute diesel buses for gas buses, which will use biogas when the new plant is ready in 2006. The goal is to convert the entire fleet of 400 buses. So far, 128 new gas buses have been introduced. This has:

- Reduced fossil CO₂ emissions by 41,000 tonnes/year.
- Reduced NO_x emissions by 850 tonnes/year.
- Reduced particulate emissions by 26 tonnes/year.
- Reduced the noise level by 50%.

The operational cost per kilometre is the same for gas as for fossil fuel. Biogas is purchased from waste treatment at the same price as natural gas.

When substituting the fuel from diesel to biogas, energy consumption increases, which was also the case in Lille. But Lille has shown that it is possible to reduce at least part of the increase. The city worked closely with the car manufacturer Renault and tested different gearboxes. Systematic tests were also made to identify why the consumption was high. Furthermore, the buses have less powerful engines and the drivers are well educated in how to operate the buses. These actions reduced the consumption of biogas from 85 m³/100 km in 1998 to 65 m³/100 km today.

Clean cars



The clean car development chain



The introduction of clean cars often follows a chain. The first step is a public fleet that carries the initial costs for fuelling infrastructure and extra costs for setting up a maintenance chain. Public fleets can be homogenous and sufficiently large to make it possible to arrange special service facilities. A fleet is also less dependent on a large network of fuelling stations. Even though municipal car fleets are too small to make a financial impact on the vehicle market, it is important that public authorities set good examples and show others that clean vehicles reduce emissions and function as well as ordinary vehicles.

The next step is to involve private companies with rather big fleets, like taxis or large delivery companies. This requires additional fuelling stations and probably more vehicle models.

Further steps will require improved fuelling infrastructure, a variety of vehicle models, and incentives such as parking discounts. In the final step, clean vehicles should be regarded as a choice, like any other choice made by vehicle customers.

Trendsetter has shown that this is a successful way for local authorities to start the market development of clean vehicles. The number of clean vehicles has actually increased considerably in Stockholm and to some extent also in Graz. More and more car manufacturers also offer clean vehicles.

For further growth, it is absolutely crucial that other European cities follow the examples and promote clean vehicles in their region. A higher demand makes it more interesting for car producers to develop new vehicles. No single European country has a big enough market to do this.

Municipal fleet

Cars in city fleets are normally small vehicles. However, the clean car models on the market are usually medium or full size cars. This is because of the small niche – vehicle producers mainly produce clean car versions of their most popular models.

Since both Lille and Stockholm have continued to change their entire fleet to clean vehicles, the cities have had to handle the lack of car models. Stockholm has bought the larger cars, knowing that they will be more attractive on the second hand market and thus further increase the uptake of clean vehicles. Lille's strategy has been to stick with their current size of cars and purchase small gas cars without the intention to release them on the second hand market. However, it has been impossible for Lille to get the manufacturers to offer such cars.

Easier buying cars together

How can the car retailers become more interested? One way is to gather many buyers in a joint procurement. An example from Stockholm shows that this can increase the sellers' interest and also lower the price. It is also clear that clean vehicle buyers need to be very active. It takes meetings, discussions and persuasion to make sellers respond to a call for tender. Experience from Lille shows that it is very difficult for a single city to influence the car industry, which has its own agenda in terms of availability of certain vehicle models.



Municipal fleet in Stockholm

The City of Stockholm started introducing a clean city fleet as far back as 1996. The first generation of these vehicles is not in use anymore. Within Trendsetter, more than 200 cars in the city fleet have been replaced by clean vehicles, partly replacing old clean vehicles but to a great extent replacing petrol vehicles.

Today, there are 465 clean vehicles in operation, which is 43% of the municipal fleet. This has led to:

- Reduced total energy consumption by approximately 25%, which is due to a high share of electric hybrid cars that are more energy-efficient.
- Reduced fossil CO₂ emissions from 650 tonnes/year to 560 tonnes/year.
- Reduced emissions of NO_x, HC and CO.
- 15% lower fuel cost for the biogas vehicles. Operating costs for ethanol vehicles have been equivalent to the cost of petrol and the fuelling cost for the electric hybrid vehicles has been 30% lower.
- 80% of drivers stating that they were very satisfied and would recommend others to drive clean vehicles.
- New and useful knowledge about the second-hand market for clean cars.

The disadvantage has been a 5% higher average maintenance cost, mainly because biogas vehicles need more maintenance and repair.

Backlash in the Stockholm city fleet

Once a city introduces clean vehicles, the number does not automatically increase. The opposite actually happened in Stockholm. With 600 clean vehicles in 2000, half of the city fleet was clean. However, this figure then dropped a few per cent. What were the reasons for this negative development?

First, the entire fleet was outsourced to a private leasing company, which led to a decrease in the total number of vehicles for efficiency reasons. It also led to decentralisation of the purchase decisions.

Several actions were taken to counteract the trend:

- Each purchasing department received a letter from the City Director reminding them of the policy to buy clean vehicles only.
- A seminar was held to inform about the different models and opportunities offered within Trendsetter.

- The Stockholm Trendsetter team designed "vehicle exchange plans" together with each purchasing department, with frequent follow-up of results. A new brochure was also produced to support the purchasers.

At the end of the Trendsetter project, the figures started rising again and in June 2005, the share was 43%.

Procurement a powerful tool

Stockholm reduced the price of clean vehicles by buying large quantities, gathering many buyers from all over Sweden. In the first stage of Trendsetter, a large nation-wide procurement was performed. It led to a framework agreement to buy 5,000 vehicles during the Trendsetter period. This procurement also resulted in prices that were 4–15% lower, depending on model, and contributed strongly to the early introduction of the Toyota Prius electric-hybrid vehicle in Sweden.

In the latest procurement of transport services, Stockholm County Council required all successful tenders to use an increasing amount of biofuels, ending at a minimum of 25% by 2006. The contract includes financial sanctions for companies that do not fulfil this. Similar agreements are used by several Swedish cities and are included in Stockholm's ongoing call for tender on taxi services.

Clean municipal fleet in Lille

Lille Metropole started introducing electric and natural gas vehicles in 1997. The long-term goal is to change the whole city fleet of 500 vehicles. During Trendsetter however, 84 of originally planned 120 vehicles were purchased due to lack of response to the tenders.

The substitution of a diesel vehicle for a gas vehicle reduces emissions as follows:

- CO₂ emissions are reduced by about 30% for gas vehicles compared to diesel.
- NO_x emissions are reduced by about 75%.
- HC emissions are reduced by 25%.
- CO emissions are reduced by 90%.

For gas vehicles, the total driving cost per km is similar to that for diesel, but the cost is 45% higher for an electric vehicle compared with diesel or gas.

Comparisons a driving force

Another difficulty can lie within the own organisation. This has been the case in Stockholm. Even if the city wants to buy only clean vehicles it has had problems to hold on to the intention. The main reason is that the responsibility for the city vehicles is spread throughout the organisation. As those in charge of purchasing also have many other responsibilities, they pay rather little attention to the issue. The Clean Vehicles group has therefore informed about clean vehicle development through visits and a regular newsletter. Also, high-level officers have been involved and a “name&shame-list” has put pressure on the different departments. The list shows how many clean vehicles every department has in relation to the total number of vehicles. The ratio should be 60% by the end of 2006. The average for all departments was 43% in June 2005.

Company fleets

Local authorities can extend the clean vehicle market by cooperating with other large fleet owners, like taxi companies, which require few filling stations thus reducing the need for extensive refuelling infrastructure.

A large number of the private companies in Stockholm use clean vehicles in their fleet. Interviews and questionnaires carried out within Trendsetter show that one in two large companies have at least one clean vehicle in their fleet. There are now more than 3,000 private clean vehicles in Stockholm.

Removing obstacles for clean vehicles

The lack of fuelling stations is one of the main reasons why companies and citizens do not switch to clean vehicles. This is an experience within Trendsetter and it is also shown in a recent study made by the city of Bremen.

Other obstacles that companies have brought forward are:

- Offered models and fuel are more expensive than conventional vehicles.
- Lack of incentives.
- Lack of knowledge and bad reputation of the former generation of clean vehicles, which often had a rather bad performance.



Thorough testing by Graz's biggest taxi company proved biodiesel to be technically as good as diesel.

Graz taxi company biodiesel pioneer

The City of Graz has cooperated with Taxi 878 for the introduction of biodiesel vehicles. Taxi 878 is one of the city's biggest taxi companies with a fleet of 210 cars.

In order to facilitate the shift to biodiesel among other stakeholders the taxi filling station is available also for the public.

Biodiesel technically as good as diesel

Graz has been a forerunner in using the new particle filter technology in biodiesel vehicles, thus eliminating the disadvantage of high emissions of particles. But initially, there were big problems with the filters clogging. At first, used cooking oil was suspected, as car manufacturers do not test this. However, analyses showed that this was not the problem. The next theory was that fossil diesel leaves sediment that is dissolved by biodiesel and then clogs the filter. If this had been correct, it would be impossible to shift between biodiesel and fossil diesel, thus restricting biodiesel use to captive fleets or in areas where the fuelling infrastructure is fully developed. In the end it was found that there was a design error in the test vehicle itself, and there have been no further problems.

The thorough testing has showed that biodiesel technically is as good as diesel, though much better from an environmental point of view. It also showed that it is possible to occasionally use fossil diesel in case biodiesel is not available.

Infrastructure



Stockholm builds new fuelling stations

Stockholm has 6 biogas stations, of which 4 were built during Trendsetter. This has led to an interest in biogas by the gas company AGA Gas, and 7 more biogas stations are planned to open in Stock-

holm 2005–2006 without a contribution from Trendsetter. Within 5 years, the goal is to extend these stations to a belt across Sweden, in cooperation with a gas company based in the west of Sweden, and to finally build a national network.

The number of ethanol fuelling stations is also growing. There are currently 26 stations and a further 10–15 will open during 2005–2006.

New legislation, proposed by the Swedish government, states that the fuel companies will have to offer at least one kind of renewable fuel at their best selling stations and eventually also at smaller stations.

New fuel supply system

Stockholm does not have a natural gas grid and the distribution of biogas has to be solved by other means. The gas company AGA Gas has provided a new, flexible and mobile fuel supply system with separate tank units that are easy to replace. The pumps are remote-monitored to make it easy to know when to switch tanks.

Incentives

Companies and private citizens become more interested in clean vehicles if they are compensated for the higher costs. Stockholm and Graz have introduced incentives such as parking fee reduction. In Stockholm, companies have been able to receive a subsidy for part of the extra vehicle cost. Also, clean vehicles are exempt from

congestion charges in Stockholm. A driver of a clean vehicle can have a discount of up to SEK1,200/month ($\approx$ €130), depending on how often he/she drives in the zone.

Stockholm's incentives have rapidly increased the interest for clean vehicles among companies and citizens. During Trendsetter, private companies and citizens have bought almost 3,000 clean vehicles. Clean vehicles represented 2% of the total car sales in Stockholm 2004 and are estimated to represent almost 5% in 2005.

A common experience is that parking incentives are a very effective way to make people more interested in clean cars. However, introducing parking discounts is often hard since there is no way to favour clean vehicles within the normal parking regulations.





Clean vehicle free parking for residents is popular in Stockholm.

Free parking in Stockholm

Stockholm finally decided, in spring 2005, to offer free parking for clean vehicles owned by residents or companies using their vehicles for commercial traffic (a special permit is needed). The main reason for the indecision was that the national parking legislation did not explicitly mention clean vehicles as a category that cities could decide on. The legal issue is still not resolved, but a national committee of inquiry is expected to find a legal solution. Stockholm has therefore chosen to offer the discount. During the first eight months after the introduction, approximately 1,350 permits have been issued.

Parking discount in Graz

Since 2004, drivers of low polluting vehicles can receive a €0.40/hour discount on the parking fee in Graz. The ordinary tariff is €1.20/hour. By inserting a special token in the parking machine the driver receives the lower tariff. To obtain this so-called "Umwelt-jeton", drivers have to register their vehicles at the city council. To avoid abuse, each vehicle also receives a special sticker to put on the windscreen.

In Graz, low-polluting vehicles are defined as vehicles fulfilling the Euro IV norm or emitting less than 140 g (130 g for diesel vehicles) CO₂ per driven km.

To enable the parking discount, a specific law by the regional government had to be adapted. This took time and should be regulated in advance by cities following Graz' example.

Another problem was that the Parking Department postponed the introduction of the parking discount due to the high cost of converting the parking meters. However, the Trendsetter team in Graz held various workshops, and involved parties finally decided to introduce the new parking tariff at the same time that the parking fees for ordinary cars were increased, which anyhow required the meters to be converted.

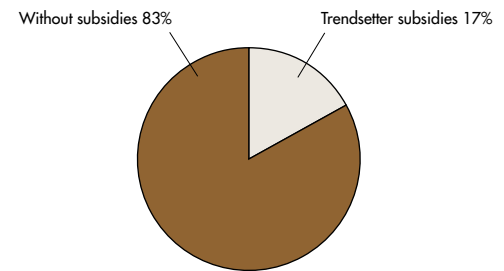
During the introduction in Spring 2004, the interest of the general public was quite high. However the parking department approved only 41 drivers of low-polluting vehicles until September 2005. The main reason was that only very few cars fulfil the set criteria, mostly because they lack particle filters. Another reason was that manufacturers and retailers do not actively promote cars that fulfil the criteria. As more and more cars fulfilling the criteria become available, Graz plans to carry out a special promotion campaign together with the car retailers.



Cities push for national incentives

The effects of local incentives can be multiplied by national incentives such as tax discounts on fuels and vehicles. Together with a network of cities, Stockholm has put pressure on the Swedish government to introduce national incentives. One of the arguments is that when the cities purchase clean vehicles and give incentives, the national government should contribute too. After more than three years of campaigning, this finally resulted in a tax exemption for biofuels and discounts on clean vehicle taxes.

Trendsetter subsidised 17% of sold clean vehicles



Stockholm and Trendsetter subsidised 422 clean vehicles between 2002 and 2004. The total number of clean vehicles sold in the same region was a little more than 4,200 during the same period.

A European definition of clean vehicles

In order to give incentives you need a definition of “clean vehicle”. Currently all cities giving incentives have a definition of their own. This works well now but will in the long run be confusing for drivers: “Can I park my clean vehicle free of charge in this city?” It is also a big problem for vehicle producers: To be able to produce clean vehicles they have to know what a clean vehicle is. Eventually, there must be a European definition.

A Swedish definition

Sweden has taken the first steps towards a national definition by proposing what vehicles should be regarded as clean when government institutions purchase new vehicles. But it will take time to reach a consensus on a national definition and it will take even longer to reach consensus at the European level. In order to keep up with the European development of clean vehicles, it is crucial to start work on a definition immediately.

Promotion of clean cars

Environmental arguments are not always sufficient – citizens and companies need financial arguments in order to become interested in clean vehicles. Therefore, the promotion of clean cars should emphasise the total costs rather than purchasing costs. Important partners in this work are retailers of vehicles, cars and alternative fuels as well as leasing and finance companies. In Trendsetter, Stockholm has especially informed and educated vehicle retailers.

Media a key player

The media is a major source of information for increasing awareness. As a result of the activities in Trendsetter, media coverage has increased and “clean vehicle” is now a well-known concept. All motor magazines and all motoring supplements in daily newspapers now include reports on clean vehicles.



Subsidies – a way to spread the message

Providing subsidies to cover part of the extra cost for a clean vehicle can be an effective way to spread the clean vehicle concept. A press release on the Trendsetter subsidy, open to companies in Stockholm, generated about 15 news articles during a period of six months. According to PR experts, this was a great success. Hundreds of phone calls were also generated and potential buyers received customised advice on clean vehicles.

Website promotes clean vehicles

The national website www.miljofordon.se has been launched through Trendsetter. The site gathers and updates all information on clean vehicles in Sweden and makes it available for potential buyers/users.

Some examples of the content:

- Definitions and basic facts on clean vehicles and fuels.
- Vehicle models and retailers.

- Interactive calculation programme that compares investment and driving economy between a clean vehicle model and the corresponding petrol/diesel model, including individual mileage/year, buying/leasing model, current fuel prices, parking discounts, congestion charging discount, etc.
- Interactive map, showing fuelling stations with addresses and clean fuel prices.
- National and relevant international legislation on clean vehicles, including taxes, subsidies and benefits.
- Clean vehicle news.

The website has clearly contributed to the promotion of clean vehicles in the cities and has more than 25,000 unique visitors/month.

According to a survey of almost 400 users, the website is regarded as reliable, neutral and contains all relevant facts on clean vehicles.

The website reaches potential buyers of clean vehicles. The survey also shows that the users would like the website to contain more information about the market for clean vehicles and environmental issues.



Network of "clean drivers"

40 well-known companies in Stockholm have started a network of clean drivers. The members include the national television, the largest daily newspaper, Ericsson and DHL (haulage company), etc. Together, these companies operate about 200 clean vehicles and act as independent ambassadors as their credibility is high among other private companies. In return, the companies receive credits for their environmental engagement.

The network is about to expand nationally and since many of the members are international (Hertz, Hewlett Packard, Scandic Hilton Hotel, Ericsson etc), there might eventually be an expansion at the European level.

Free test-driving for Stockholm companies

Stockholm has offered companies free test-driving of clean vehicles for one week. The aim was to convince companies that clean vehicles fulfil their requirements for operation, performance, safety, economy and environmental issues.

In one questionnaire, 90% were very or rather satisfied with the function of the car; 90% were also very or rather satisfied with the performance. Drivers from 70 companies answered the questionnaire.

Fifty of the companies were also asked afterwards if they had purchased a clean vehicle. This showed that 34% had purchased one or more clean vehicles. Another 34% were planning to buy one or more.

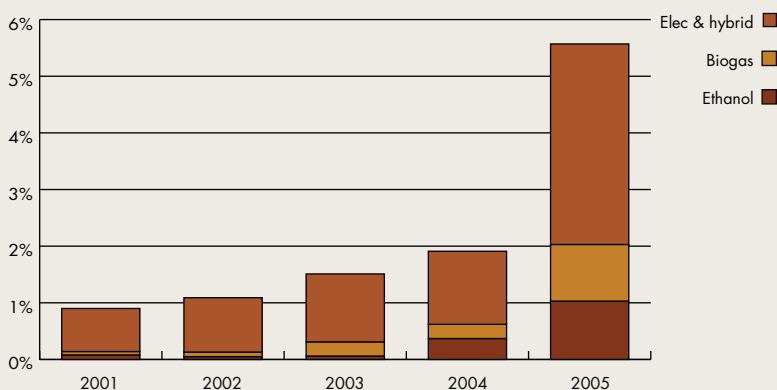
Free test-driving mainly speeds up companies' purchases. Several companies had plans to buy a clean vehicle before the test. The companies' own policies influenced the decision to actually purchase a clean vehicle more than the test-driving opportunity.

Sales increasing in Stockholm

15% of inhabitants in Stockholm believe that they will buy a clean car in the near future and 53% are aware of clean vehicles. Trendsetter has had a direct influence on the increase of 2,438 clean vehicles purchased by companies and private citizens in Stockholm. During 2005, another 2,500 vehicles are to be purchased. The results so far:

- Total energy consumption has decreased from 128 to 116 TJ/year without a negative impact on mobility.
- The total amount of fossil CO₂ (including production and distribution of fuel) has decreased by 5,400 tonnes/year compared to petrol vehicles. There is also a small reduction of NO_x, HC and CO.

Market share for clean vehicles



Market share for clean vehicles has increased fourfold since the start of Trendsetter

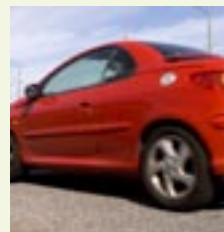
Conclusions and recommendations

Clean vehicles – a way to reduce emissions

- + Clean vehicles are a cheap and suitable way to reduce emissions from traffic that cannot be substituted by other modes of transport.
- + Trendsetter has proved that it is possible to change a whole city bus fleet in a few years.
- + Local authorities are key players and need to take the lead. They are able to initiate market development. Incentives, definitions and initiatives at national and EC levels are necessary in the long run, but local authorities can start today.
- + European cooperation is necessary to continue the development. Single country markets are too small to carry the development.
- + Clean vehicles can be introduced step-by-step, starting with the cities' own fleet, continuing with private fleets such as taxi, and then addressing a broader public when the fuelling infrastructure is in place.
- + A long-term perspective is necessary – on incentives, infrastructure and all communication with stakeholders.
- + The procurement power is increased if many buy together. Joint procurement of light and heavy vehicles as well as fuels should be encouraged. Transport services should be required to be clean.
- + Setting up a sufficient number of filling stations is crucial for creating a market for biofuel vehicles.
- + Incentives are needed and incentives related to parking and access are specifically effective.
- + National incentives are extremely helpful – work to obtain them.
- + Subsidies for vehicles may be needed initially.
- + Increasing production capacity in Europe (biogas, biodiesel, ethanol) should be supported, as should construction of infrastructure for alternative fuels.
- + Tax legislation that favours clean vehicles and fuels should be created.
- + There is a need for national definitions on clean vehicles.
- + It is good to create a clear strategy for a large-scale introduction of clean vehicles.

Recommendation to EC:

- + Make the Biofuels Directive compulsory.
- + Ensure that EU legislation does not hinder member states from using tax reductions to support biofuels.
- + Suggest EU framework for national tax reductions and other economic measures promoting a shift from fossil fuels to biofuels.
- + Facilitate European cooperation, especially joint procurement and shared experience.
- + Implement actions to encourage public organisations and private companies to use environmental requirements in the procurement of transport services.
- + Support the development of new cost-effective methods to produce and upgrade biofuels.
- + Implement standards for biofuels, storage/distribution and vehicles.
- + Support research and technology for using electric-hybrid technology in bio-fuelled vehicles.
- + Adopt a common definition of clean vehicles for Europe.



Trendsetter – a part of Civitas



Trendsetter is a European demonstration project aiming at improving mobility, air quality and quality of life while reducing noise pollution and traffic congestion by promoting:

- Innovative management methods
- Improved logistics for greater energy efficiency
- The use of public transport and car sharing
- Increased use of zero and low emission vehicles

The five Trendsetter cities Graz, Lille, Péc, Prague and Stockholm have implemented 53 measures grouped in eight thematic areas: Access restrictions, Integrated pricing strategies, Public passenger transport, New forms of vehicle use, New concepts for the distribution of goods, Innovative soft measures, Integration of transport

management systems and Clean public and private fleets. All in all, 20 organisations, around 300 people and 175 subcontractors have been involved in the work. Trendsetter started in 2003 and will end in the beginning of 2006.

Trendsetter is one of four demonstration projects within Civitas. The other projects are Vivaldi, Tellus and Miracles. **The Civitas Initiative** is coordinated by cities and aims to achieve a radical change in urban transport by using technology and policy-based measures. The Civitas I initiative (2002–2006) includes 19 cities, see map below. Together with the 17 cities in Civitas II (2005–2009), 36 cities participate in Civitas, supported by the European Commission.

Each city's actions are based on the categories of measures that form the backbone of the Civi-

tas initiative. The mix of strategies chosen by each city differs. Although aiming for the same result, each takes specific local circumstances into account.

The cities' involvement in the different thematic areas is shown in the adjacent picture.

Participating cities

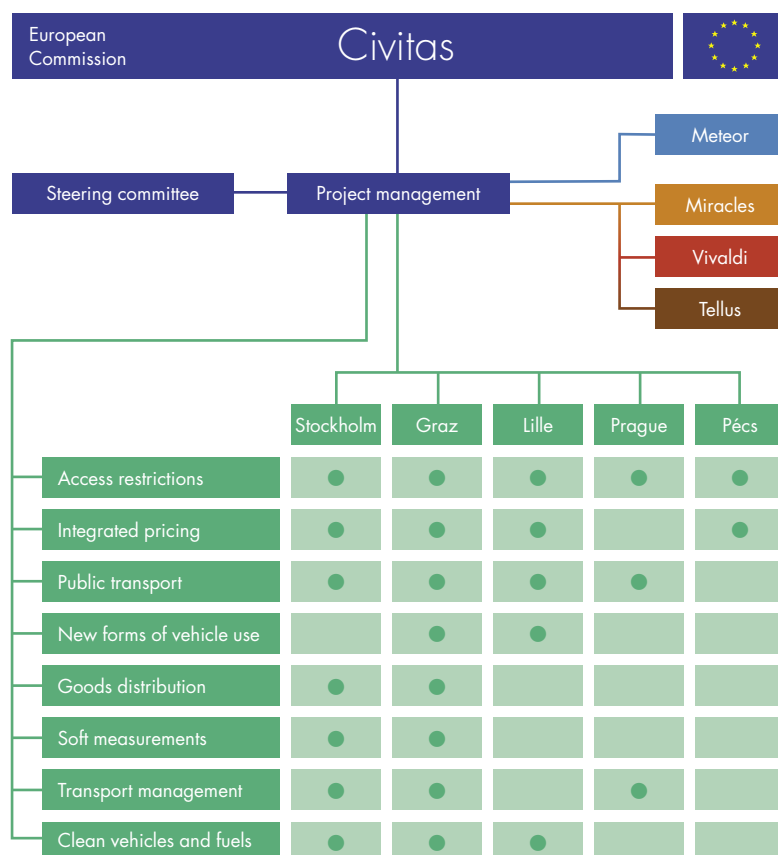
Graz

With nearly 230,000 inhabitants, Graz is the second largest city in Austria, the capital of the Styria province and the cultural, economic and university centre of the region. About 80,000 commuters travel to the city of Graz daily. On an average weekday, 47% of commuters travel by car, 19% use public transport, 20% are pedestrians and 14% cycle.

Graz has a historic centre with many pedestrian precincts and much bicycle traffic. It was the first city in Europe to implement a speed limit of 30 km for the entire city area (except major roads) and the first Austrian city to open a mobility centre.

The main problem Graz faces is the rise of car use due to a tendency of people moving to the city outskirts. The increasing traffic as well as the topography and climate in Graz, lead to high air pollution levels in the city. Information technology will be used to make public transport more user-friendly and the services more attractive.

The following measures have been implemented in Graz within Trendsetter:



WP	Measure
Access Restrictions	Implementation of strolling zones
Integrated Pricing Strategies	Integrated pricing strategy for parking zones – differentiation between polluting and non-polluting vehicles
Public Passenger Transport	Customer-friendly stops for bus and tram Seamless linkage of modes
New Forms of Vehicle Use	New services and services for special customer groups Increasing car occupancy Site level Mobility Management
New Concepts for the Distribution of Goods	Distribution of goods – Green city logistics
Innovative Soft Measures	Innovations in bicycle transport Marketing/information and quality management Awareness of speed reduction and less car use Taxi drivers as information multipliers for clean transport Integrated Mobility Centre
Integration of Transport Management Systems	Dynamic traffic management system Technical basis for an efficient customer focused operation and information
Clean Public and Private fleets	Clean and user friendly biodiesel bus fleet Biodiesel taxi fleet and biodiesel service station Optimisation of the biodiesel collection system





Lille

Lille Metropole in France is an urban network of 85 communes with 1.2 million inhabitants. The community is close to the Belgian border and cooperates closely with its counterparts in Belgium. It is a base for distribution and a node for major north-south and east-west routes in Europe.

Lille has built up a strong public transport network. On an average weekday, 150,000 passengers travel by bus, tram, commuter trains or metro. The following measures have been implemented in Lille within Trendsetter:

WP	Measure
Integrated Pricing Strategies	Smart card systems and integrated ticketing
Public Passenger Transport	Public transport safety
	Intermodal local/regional transport interchanges
	Park and Ride facilities
New Forms of Vehicle Use	Company mobility plan in the administration fleet
	Urban Mobility Plan
Integration of Transport Management Systems	High level service bus routes
Clean Public and Private fleets	Biogas bus fleets
	Clean municipal fleets
	Analysis of the biogas experience



Pécs

The City of Pécs with 170,000 inhabitants is a medium-sized cultural, educational, commercial and health centre in Hungary, 40 km from the Croatian border. In the last decade the number of cars and the number of tourists and students have increased rapidly, creating a huge demand for parking spaces and public transport. In November 2000, the early Christian burial chambers in the city centre received UNESCO World Heritage status, providing the municipality with new tasks to protect and preserve the heritage.

The following measures have been implemented in Pécs within Trendsetter:

WP	Measure
Access Restrictions	Establishment of a car-free zone in the inner city
	Preparation of a new traffic and transport strategy
Integrated Pricing Strategies	Establishment of a zone-model parking in the central city area



Prague

The City of Prague is the capital of the Czech Republic and the country's largest city with 1,300,000 inhabitants. On an average weekday, 44% of travelers use public transport, 34% go by car and 22% are pedestrians and cyclists. A total of 1,160 million passengers per year uses the public transport system in Prague.

Prague has a high concentration of both political and financial administration, industry, trade, education, research and tourism. This requires good traffic management. One of the biggest problems is the very fast increasing number of private cars. It has more than doubled since 1990. A new traffic policy promotes public transport, development of traffic infrastructure and regulation of car traffic, particularly in the city centre.

The following measures have been implemented in Prague within Trendsetter:

WP	Measure
Access Restrictions	Widening of Environmental Zone for vehicles > 3.5 tons
Public Passenger Transport	Linking different ways of public transport
Integration of Transport Management Systems	More adaptive signal control in a bus priority system

Stockholm

The City of Stockholm is the capital of Sweden and the country's largest city with 770,000 inhabitants. On an average weekday, over 600,000 passengers go by public transport in the county of Stockholm. Of all travellers, 46% travel by car, 23% use public transport, 29% are pedestrians and cyclists and 2% use other modes.

The biggest traffic problems include an increasing number of vehicles, congestion on many main roads, heavy duty traffic, limited rail track capacity and few cyclists. Moreover, there are problems with the air quality in inner city areas especially due to a high concentration of NO_x and particulate matter. Noise levels are also high.

Stockholm is improving its transport system environmentally by substituting conventional vehicles with clean ones and making logistic services more effective. Better public transport and intelligent traffic information techniques are other important fields.

The following measures have been implemented in Stockholm within Trendsetter:

WP	Measure
Access Restrictions	Widening of the Environmental Zone
	Congestion charging
Integrated Pricing Strategies	Smart card systems and integrated ticketing
	Reduced parking fees to promote clean vehicles
Public Passenger Transport	Increasing number of public transport passengers
New Concepts for the Distribution of Goods	Material logistic centre – to optimise freight deliveries at construction site
	Logistic centre for Old Town of Stockholm
Innovative Soft Measures	Making cycling attractive (B&R information on the Internet)
	Creation of a visitors' web for optimal trip planning
Integration of Transport Management Systems	Traffic monitoring and supervision
	Accessible road network (street) data
Clean Public and Private fleets	More adaptive signal control in a bus priority system
	Clean and efficient heavy vehicles
	Waste collection with biogas-vehicles
	Clean municipal fleets
	Making clean vehicles less expensive
	Increasing clean vehicle use in private company fleets
	Web portal for drivers of clean vehicles
	Improved biogas refuelling infrastructure



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Trendsetter in sustainable urban mobility

Five European cities have worked hard for almost three years to set new trends for sustainable urban mobility. The Civitas I project Trendsetter is now ended, but the work will continue and the results from the project will hopefully help other cities

The Trendsetter measures – 54 all in all – and their outcomes are described in this report. The Trendsetter cities Graz, Lille, Pécs, Prague and Stockholm have gathered their experiences from Trendsetter about:

- How to promote alternatives to private cars
- How to improve goods distribution
- How to reduce emissions by promoting clean vehicles.

More info about Trendsetter, downloads etc are available at
www.trendsetter-europe.org

Trendsetter is part of the CIVITAS Initiative

Under this initiative, the European Commission supports ambitious and large-scale projects, which genuinely combine energy and transport in a coherent manner introducing sustainable urban transport policy strategies and innovative ways of improving traffic situation in cities. The aim is to achieve a significant change towards sustainable transport modes. The Commission provides 35% of the funding. The Civitas Initiative supports 8 projects involving 36 cities. In addition, nearly 50 other cities are members of the Civitas Forum, providing a platform for the exchange of best practice, ideas and experiences between experts and politicians. More information about Civitas on:

www.civitas-initiative.org



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