DELIVERABLE 6.7

CONTRACT N°	TIP4-CT-2005-516420
PROJECT N°	FP6-516420
ACRONYM	QCITY
TITLE	Quiet City Transport
Subproject 6	Report on the effect of economic and related incentives
Work Package 6.2.3	Economic and related measures
	Economic and related measures
Written by	Elisabeth Ström, Jörgen Bengtsson SEA
Date of issue of this report	2009-03-06

PROJECT CO-ORDINATOR PARTNERS			
	Acoustic Control	ACL	SE
	Accon	ACC	DE
	Akron	AKR	BE
	Alfa Products & Technologies	APT	BE
	Banverket	BAN	SE
	Composite Damping Material	CDM	BE
	Havenbedrijf Oostende	HOOS	BE
	Frateur de Pourcq	FDP	BE
	Goodyear	GOOD	LU
	Head Acoustics	HAC	DE
	Heijmans Infra	HEIJ	BE
	Royal Institute of Technology	KTH	SE
	Vlaamse Vervoersmaatschappij DE LIJN	LIJN	BE
	Lucchini Sidermeccanica	LUC	IT
	NCC Roads	NCC	SE
	Stockholm Environmental & Health Administration	SEA	SE
	Société des Transports Intercommunaux de Bruxelles	STIB	BE
	Netherlands Organisation for Applied Scientific Research	TNO	NL
	Trafikkontoret Göteborg	TRAF	SE
	Tram SA	TRAM	GR
	TT&E Consultants	TTE	GR
	University of Cambridge	UCAM	UK
	University of Thessaly	UTH	GR
	Voestalpine Schienen	VAS	AT
	Zbloc Norden	ZBN	SE
	Union of European Railway Industries	UNIFE	BE

PROJECT START DATE	February 1, 2005
DURATION	48 months
	Project funded by the European Community under the SIXTH FRAMEWORK PROGRAMME PRIORITY 6 Sustainable development, global change & ecosystems

This deliverable has been quality checked and approved by QCITY Coordinator
Nils-Åke Nilsson

TABLE OF CONTENTS

0 EXECUTIVE SUMMARY

There is a wide range of possible measures to be taken in order to make economic incentives for a more environmental friendly and quieter traffic. Examples are taxation, parking fees, subsidies and alternative modes of transport, such as public transport and bicycles. The effect can be very high, e. g. if you make expensive to drive in to a city centre. The effect on the noise situation may be calculated provided that you know such factors as the effect on traffic flow, the composition of the fleet and the distribution of vehicles over time.

When different measures have been applied an evaluation has sometimes been done. These evaluations have rarely included environmental aspects and when they have been included they have very often been limited to the influence on the air quality. There are some examples described where the noise aspect has been evaluated.

Very often it is hard, close to impossible, to predict the impact on noise. As mentioned, if you know or can make a good estimation of how the traffic is affected by the measures, you can also make a prediction of how the noise will be changed.

If no prediction can be made it is important to ascertain that the measures will have a positive effect on the noise situation.

The most efficient type of measures if you want to make local improvements seem to be restrictions of access. That can be achieved by prohibition or prizing. The restrictions may be accompanied by improved public transport, a well working parking policy and improvements for bicycling.

For more large scale improvements taxes and subsidies, including general improvements of public transport seem to be best suited.

0.1 OBJECTIVE OF THE DELIVERABLE

The objective of this deliverable is to describe some economic and related measures that may be considered as measures against noise from road and/or rail. An attempt has been made to describe the pros and cons of each measure as well as the costs and the effects on the noise situation.

0.2 DESCRIPTION OF THE METHOD USED

Since no methods have been possible to study within the framework of this report this study consists of material already available in literature and on the internet.

0.3 BACKGROUND INFO AVAILABLE AND THE INNOVATIVE ELEMENTS WHICH WERE DEVELOPED

What this study may give the reader that is not found elsewhere is a compilation of different methods used around the world and their effect on the noise situation. It provides an easy way of checking e.g. if an idea has been tried earlier and what the result was.

0.4 PROBLEMS ENCOUNTERED

The most important problem encountered is the lack of description on the noise effect that is so common in descriptions of different measures. An evaluation of the environmental aspects has rarely been done, and if it has been done it mostly concerns air quality.

0.5 PARTNERS INVOLVED AND THEIR CONTRIBUTION

The study is written by The Environment and Health Administration at the City of Stockholm with helpful support mostly from Acoustic Control, Accon, Akron and TNO.

0.6 CONCLUSIONS

Economic incentives can contribute towards reducing transport demand and changing transport behaviour. By enforcing the user-pays principle only transport users pay for the cost of their mobility, including the magnitude of the road and the external damages they cause. Road traffic authorities and municipalities are given incentives for creating measures that decrease traffic noise. One of the problems in connection with this is that they do not always have control over the tools. The governments take decisions on taxes and charges but the requirements for the vehicles are handled on an EU level. The results being that these tools are seldom used simultaneously in the analysis where the aim is for cost effective choices between measures.

Receiving the publics' approval and understanding is one of the most important aspects of implementing mobility management policies. The measures are often unpopular because public awareness is low. The disadvantages are often more obvious than the advantages. A higher price or having to change the pattern of travelling is easier to understand than a better environment or an improved delivery of goods. Extensive information about the measures and of alternative modes of transport is crucial for obtaining public acceptance, especially when imposing restrictions. Economic incentives are most effective when they are part of a comprehensive approach, for example, using the revenue from congestion charges to improve public transport. Although taxes and charges seldom are popular they tend to stimulate technical engineering and higher efficiency of vehicles.

Most traffic-related measures are designed to reduce impact on the environment but may however have a positive effect on the noise situation.

0.7 RELATION WITH THE OTHER DELIVERABLES (INPUT/OUTPUT/TIMING)

The deliverable 5.13, Performance report of applied measures (quiet vehicle zones), is related to this report as it describes an improved way of applying economic incentives.

1 CONGESTION CHARGING

1.1 LONDON

London introduced its congestion charging program in February 2003. The aims of the program are

* to reduce congestion

* to make radical improvements to bus services

* to improve journey time reliability for car users

* to make the distribution of goods and services more efficient

We may notice that the environmental aspects in general are not mentioned, and neither is the noise an aspect.

Every year an Annual Monitoring Report is published by Transport for London, TfL. The report "Impacts Monitoring, Fourth Annual Report" published in June 2006 describes the monitoring of the noise situation.

The method for evaluating the ambient noise is to use fixed long time measurement stations at some indicative places in and around the charging zone. The Annual Report mentioned above describes in more detail the location of the places and the measured noise levels. The conclusion drawn by TfL is "that there was no evidence of significant changes (in noise levels) at the sample sites that might have been associated with the introduction of congestion charging." In the report is also a remark saying that "Measured traffic changes of the extent described elsewhere in this document would be unlikely of themselves to give rise to significant changes in ambient noise."

The changes of traffic flow entering the charging zone are for cars and minicabs close to a reduction of 40%. On the other hand other types of vehicles show a much smaller reduction, and some (taxis, buses and coaches and (possibly) powered two-wheelers), even show an increase. Mentioning this one must also add that TfL concludes that the congestion charging meets the principal traffic and transport objectives. The reductions in traffic flow are enough to meet the objectives.

There is a fifth annual report published in July 2007. Noise monitoring is not dealt with in that report so the scheme seems to have been abandoned. Noise is actually only mentioned twice in the fifth report. In "Key findings from previous reports" it says that "Sample surveys of ambient noise in and around the congestion charging zone showed a mixed picture that was more reflective of local and measurement issues than indicating any consistent congestion charging effect." TfL has not been able to detect any improvement, or changes at all, in the noise situation.

There is however one indication in TfL's report that the noise situation has changed. Public opinion polls show that respondents living inside the charging zone tend to recognize the benefits of the scheme, and noise is mentioned among those. An other

report, "Central London Congestion Charge Social Impacts Surveys 2002, 2003" state that respondents living in inner London but outside of the charging zone tend to recognize an increase in noise, linked to increase in traffic.

The somewhat surprising fact that we have a perceived change in noise levels but no actual monitoring of it can be explained. Changes in traffic flow have to be rather substantial in order to lead to clearly recognizable changes in noise levels. Measurements of roadside noise are affected by many factors other than the traffic flow. Speed, proportion of heavy vehicles, weather and pedestrians and other noise sources are examples. It is understandable that no significant changes could be detected. However even a small reduction, or increase, of the noise levels exposed to a large number of people give a reduced, or increased, number of people annoyed.

In February 2007 the charging zone was extended, the so called Western Extension.

1.2 STOCKHOLM

Extract from "The Stockholm Trial, facts and results – Expert Group Summary June 2006".

> Noise
>
> Traffic noise is a major problem, both in the Stockholm region and in Stockholm's inner city. One way of reducing the noise problem is to reduce the amount of traffic. It was, therefore, natural to ascertain whether the traffic reduction that was one of the aims of the Stockholm Trial would lead to a reduction in the problems of road traffic noise. The anticipated result was that the trial would not lead to any dramatic improvements in the noise situation. This is because considerable reductions in traffic flow are necessary in order to achieve any improvement. Halving the traffic flow produces a reduction by 3 dBA, which is a scarcely audible change.
>
> The Stockholm Trial provides large amounts of traffic data. There is a large number of stretches of road and points where we know the volume of traffic before the trial, in the spring of 2005, and its volume during the trial, in the spring of 2006. This data has been analysed in such a way that the <u>difference</u> in noise emissions between the two points in time has been ascertained. The details used are traffic flow, i.e. the number of vehicles passing in any 24-hour period, speed, and the proportion of heavy traffic, where these details have been available.
>
> What is more, monitoring data has been analysed from the two fixed monitoring stations operated by the City of Stockholm Environment and Health Administration *(Miljöförvaltningen)*. These stations are located on Sveavägen and at Observatorielunden.
>
> The result of the survey is that the traffic noise situation has only been affected to a small extent. In total, results from 152 monitoring sites have been analysed. Of these six show a rise in traffic noise levels of 1 – 4 dBA. Two of the sites are near the Södra länken bypass tunnel; four of them are in the inner city. The sites in the inner city follow no evident pattern. In one case another

monitoring site nearby shows a small reduction in traffic noise. A reduction in traffic noise by 1- 4 dBA was recorded at 18 sites.

Monitoring data from the fixed monitoring stations show that, for Sveavägen, the noise has diminished by less than 1 dBA, which agrees with the estimates there. At Observatorielunden noise has diminished during the trial by approx. 2 dBA, compared with the same period in the previous year. There is no monitoring station to compare with, as the station is in a park and may be said to reflect the background level and sound from activities in the park.

The levels of the changes that have been recorded is relatively modest. It is barely possible to hear a change in sound level of 3 dBA. In order for us to perceive the change as a halving or doubling of the sound level, this has to change by 8 – 10 dBA.

Reducing the sound level by a few decibels is not enough to solve the problems of traffic noise. The level in excess of acceptable values is considerably greater than this, as is clear from figure 1 in Chapter 1. (Not included in this report.)

To the extract above may be added that the lower noise levels were not visible in surveys where people stated whether they were annoyed by traffic noise. There was no difference detected in annoyance before and during the trial.

1.3 OTHER EXPERIENCES

In general, the vast majority of measures have been implemented for congestion and safety reasons with noise reduction as a secondary effect.

In Singapore the aim of the congestion charge is to reduce the congestion and aid the general flow of the traffic. Payment is by ERP (Electronic Road Pricing) and the drivers have to pay every time they pass by an electronic toll station going into the city centre. The reduction of rush hour vehicles is approx. 10%. In Singapore the aim for the transport authority is a steady traffic flow, therefore average speeds are measured every half hour. A pricing overview is done every three months to readjust the prices according to the speeds. Are the speeds higher, the charge can be reduced and vice versa. Motorcycles, taxis, light, heavy and very heavy vehicles pay charges, as well as busses. The only vehicles exempted from charges are police, ambulance and fire service.

Payment: Inside the cars is a transponder where a pay card is put. The cards are issued by a consortium of banks and can be cash refilled at petrol stations and automatic teller machines.

No data has been found on the impact of the congestion charging on the noise situation.

In London the aim of the congestion charge is also to improve the public transport and to reduce travel time.

After a referendum, where the inhabitants of the city of Stockholm voted for a continuation of the congestion charges, it has, since 1st of August 2007 become permanent. Although the aim of the trials were partly environmental, the aim of the congestion charge is first and foremost to change the individuals driving patterns, although the income from the charges will be used to help finance road infrastructure. There is no organized evaluation of how the noise levels are affected by this congestion charging. Traffic flow is evaluated, however not to the same extent as during the trial, and the two fixed monitoring stations mentioned in 2.2 are still working.

A few Norwegian cities, including Oslo and Trondheim, have introduced road tolls for the sole purpose of financing new roads. No evaluation of the impact on traffic noise has been found.

1.4 POSSIBLE IMPROVEMENTS

Before introducing a road charge system it is important that there are other alternatives for transportation, extended public transport and roads that are free of charge.

Several of the schemes in use have exemption for certain categories of vehicles. Some examples are environmental friendly vehicles, busses and motorcycles. In Stockholm environmental friendly cars are excluded from the congestion charging, at least for the time being. When defining what cars are environmental friendly noise is not an aspect. If the definition was broadened to include noise or if a special reduction or exemption was introduced for silent vehicles the fleet within the zone would slowly become less noisy. This would also affect the situation outside the zone but to a lesser extent. Quantification is extremely difficult but in Sweden the sale figures for environmental friendly cars has risen very much during the last years. There are other bonuses as free parking in many cities and tax subsidy (described in 4.2). The effect of exemption from congestion charging can not be separated from the other factors influencing the sale figures. Several of these bonuses are to be abandoned by 2009. There has not been a discussion of to what extent that will influence the noise situation.

The concept where noisy vehicles pay to enter a zone is described in the Qcity-project. Please see www.qcity.org, results and SP5.

There is much more to read about road pricing at www.progress-project.org.

1.5 COSTS AND BENEFITS

The costs for introducing congestion charging are substantial. The cost for the Stockholm trial was 3 800 000 000 SEK, roughly 380 000 000 Euros. Compared with the revenues during the trial it was a financial disaster. The system is however now working on a permanent basis and producing revenues that are directed back to investments in infrastructure.

The benefits are also substantial. A better working traffic with much less congestion is the most obvious. There are also environmental improvements such as less emission of air pollution. The influence on noise is not obvious but at least it is positive. It is important

to remember that disturbance may be reduced even if the equivalent noise levels are not affected very much.

2 TAXES

Taxes are used for several purposes. An obvious reason is to produce an income to the state or regional or local administrative level. They can also be used to encourage or discourage public behaviour in a desired direction or to cover the costs for e.g. the road that is used.

2.1 DIFFERENTIATION OF TAXES ON ROAD VEHICLES

The demands on the design and quality of the roads are very different for different types of vehicles. A motorcycle does not demand as much of a road as a 40 ton truck. The vehicle tax is generally depending on such factors as gross weight, engine performance or type of fuel. Noise emission is generally not a factor that is in use when deciding the amount of tax.

A common way of constructing the vehicle tax is by applying an annual tax. In Germany and Austria low-noise trucks are encouraged by lower taxes. They are also excluded from night restrictions in noise sensitive areas.

One country that recently has changed its way of deciding the vehicle tax is Sweden. The determining factor used to be the weight, so with the example above a motorcycle paid only a fraction of the tax of a truck. The tax has now been changed so that it is partly based on the calculated emission of carbon dioxide. Noise is not an aspect but the construction of the tax clearly indicates how a noise based vehicle tax could be constructed.

Fuel is generally taxed as well as the vehicles. An advantage with fuel taxation is that the more you drive, and make noise, the more tax you pay. Often there is also a connection between the size of the vehicle and the noise emission and the fuel consumption. A larger vehicle consumes more fuel and produces more noise. Motorcycles are often an exception to this rule of thumb.

2.2 KILOMETRE PRICING

You can charge the tax by the number of kilometres driven in stead of by ownership. This method can fully or partially replace other taxes and follows the user-pays principle. The Netherlands has chosen a system of per-kilometre pricing at the end of a journey, in effect, lower prices for clean, economical and safe vehicles. Drivers using less busy roads or driving outside peak hours also pay less. To implement the systems the technologies used are from GPS-like systems to ANPR (automated number plate recognition). Purchase tax and motor vehicle tax are to be phased out. With the new system it is estimated that the number of kilometres drivers cover will decrease with 15%. Procurement is planned to start in 2008 and the introduction is to be in 2011 for the goods traffic and in 2012 for passenger cars. In 2018 the system will fully applied. By then there will be no more fixed car taxes. The expected impact on the environment has been calculated. The focus has been on air pollution, in particular national emissions of CO_2, NO_x and PM_{10}. The effects on local air quality and on noise have not been possible

to predict. The Ministry of Transport, Public Works and Water Management does say that an improved impact on the noise situation may be achieved by further optimization of the rates, e.g. by using higher rates in areas with a large amount of noise pollution. For further information on this scheme, see http://www.verkeerenwaterstaat.nl/english/topics/mobility%5Fand%5Faccessibility/roadpricing/.

Kilometre pricing for heavy vehicles has been introduced in Germany, Austria, Switzerland and the Czech Republic. Similar system are planned, or at least seriously discussed in Hungary, Slovakia, The Netherlands, Poland, Great Britain, Slovenia and France.

The main environmental benefits of kilometre pricing for heavy vehicles are in the field of climate gases. The systems aim at making transports more efficient and may be differentiated in order to make more energy efficient and less air polluting vehicles pay less per kilometre. The positive effects on the noise situation are mainly caused by the decrease in kilometres driven. A stimulation of energy efficient vehicles and vehicles that produce less air pollution may lead to a quicker change to modern vehicles. That is expected to have positive effects on noise emission as well.

2.3 COSTS AND BENEFITS

The obvious costs for taxation are negative, i. e. they are an income, from the society's point of view. The taxes that apply to transportation are generally substantial. What is important when dealing with environmental aspects and the noise issue is to construct the taxes in such a way that they encourage good behaviour and discourage bad behaviour.

If the taxes do not have the intended function of encouraging and/or discouraging the external cost for society can be very high. An example could be that taxes that in one way or other encourages noisy traffic leads to high costs caused by health problems.

Traffic related taxes should be constructed in such a way that the motorist pay more the more he or she drives and more if a noisier vehicle is used.

3 SUBSIDIES

There are several kinds of public subsidies in the transport sector, these include provision of infrastructure, direct transfers, differences in fuel taxations and taxexemption for some parts of the transportation service. The aim is to reduce cost for certain transport modes including public transport or multimodal transport.

3.1 SUBSIDIES FOR TRANSPORTS AND INFRASTRUCTURE

According to ELTIS (European Local Transport Information Service) road transport receives more than 43% of the transport subsidies, most of which are for infrastructure. Transport related subsidies can influence transport management decisions as well as transport demand. The subsidies are paid for by public budgets or affect public budgets. Infrastructure, direct support to operators, debt reductions and pension contributions are all examples of subsidies. With subsidies it is possible to affect transport management in relation to volume and composition of vehicle fleets, route planning and environmental performance. (EEA Technical report No 3/2007)

3.2 TAX SUBSIDIES

Differences in fuel taxation may benefit cars that use renewable fuels. Bio-gas or electrically powered vehicles may be stimulated by a lower tax on their fuel. These vehicles, and particularly electric cars, are less noisy than ordinary cars.

In Sweden a bonus for environmental friendly cars is paid by the state. The bonus of 10 000 SEK (approximately 1 050 Euros) is paid to private individuals who purchase a new car that is classified as an environmental friendly car. The bonus is paid when you have owned the car for six months. The Swedish classification of environmental friendly cars does not take noise emission in account. However hybrid vehicles and vehicles with low air emissions (less than 120 mg/km CO_2) are included. These vehicles are in general more silent than others and the subsidy may also speed up the introduction of new vehicles in the total car fleet. If the subsidy has an effect on noise it is considered to be positive. Quantification can not be done. There has now been a decision taken to phase out this bonus earlier than expected. Cars purchased after 1 June 2009 will not receive the bonus.

In air transport there is a subsidy, or rather an absence of a tax, which has negative effect on the noise situation. There is no tax on jet fuel, presumably because it has been too difficult to make a durable agreement between all countries involved in international air transport, which are all countries. The other modes of transport, which are less noisy than air traffic, have to pay taxes for their fuels so air transport has a competitive advantage. The impact is strongest on short and medium length air travelling, since there is no real competitor on long distance travelling. Quantification is not possible to make.

3.3 DIFFERENT TYPES OF SUPPORT OR DEDUCTIONS FOR CAR POOLING

The use of car pools may affect the noise situation in two ways. The cars that are being used tend to be newer than the average car on the street. When purchasing, or leasing, cars to a car pool it is also possible to demand for environmental friendly and/or more silent cars. Cars in car pools ought to be less noisy than other cars. Another way of affecting the noise level is by lesser use. Since the costs for using a car in a car pool is more direct and obvious compared to those for normal owning it is likely that the car is used more seldom.

Car pools may be exempted from parking fares and road pricing tolls. Other incentives may include clearance for car poolers to travel in the bus lanes and event oriented car pooling to major soccer games, concerts etc. Car pools may also have designated parking places where other cars are not allowed. This has been tried in Hammarby Sjöstad in Stockholm.

3.4 INCREASE OF THE SUMS THAT ARE PAID FOR SCRAPPING OLD CARS

In Sweden there has been several campaigns offering a substantial amount of money for cars that are scrapped at an authorised car dump. The main reason for these campaigns has been to decrease the number of scrap vehicles that were left at environmentally unsuitable places. A side effect was that they hastened the scrapping of old cars that were still in use as well. These old cars were presumably noisier, and more air polluting, than the average car. Now there is no campaign. The system has been changed “producer’s responsibility”.

3.5 COSTS AND BENEFITS

Subsidies can be very efficient as a means to encourage good behaviour. The long term effect has to be considered. If the subsidies are changed to often it will lead to an uncertainty in the public and the public confidence in new subsidies may be lower.

The costs need not be very high if you take into account what other costs society would have if the subsidies were not in use.

4 ACCESS RESTRICTION

4.1 CAR FREE ZONES – PEDESTRIAN ZONES

- Motor vehicles are completely prohibited or only allowed during restricted hours.
- Residents may be allowed to drive in.
- Broad pavements, speed regulations, physical speed regulators etc.

Measures like these are naturally very efficient when it comes to decreasing the traffic noise. It may actually be eliminated totally. Some traffic noise will be present at most cases, such as from delivery of goods, collection of garbage, ambulances and so on. With good restrictions that will not be a real problem. If other types of traffic are to be allowed in the zone it is important to keep the speeds down which may be achieved with a good design of the roads that discourage high speeds.

4.2 HEAVY DUTY VEHICLE RESTRICTIONS

4.2.1 Example Sweden

In Sweden four major cities have an environmental zone for the inner city since 1996. The regulations have been changed during the years and are now based on the emission class. Vehicles in Euro-0 and Euro-1 are allowed inside the zone until they are six years old, Euro-2 and Euro-3 until eight years, Euro-4 until 2016 and Euro-5 until 2020. So, the better the emission class is, the longer the vehicle is allowed to drive inside the zone. No evaluation has been done on to what extent the environmental zone affects the noise levels. The zone in known to be efficient in the way that only a small amount of the heavy vehicles driving inside the zone are to old to be allowed there. At some occasions the police have carried out inspection campaigns. When unauthorised vehicles were found they had to be towed out of the zone. The knowledge of these campaigns spread rapidly and the number of unauthorised vehicles fell to even lower levels.

There has not been an evaluation of the impact on the noise situation but the effect is clearly positive. The noise emission from heavy vehicles has been decreased during the last decades so the higher amount of modern vehicles is good. Also older vehicles tend to be in a worse state generally and the risk of excessive noise is higher. Passenger cars have not shown the same decrease in noise emission.

4.2.2 Example Rome

The metropolitan area of Rome has 3,981,000 inhabitants and about 1,800,000 private vehicles. Only 40 % of the total trips are made by public transport.

The 4.8 km^2 city centre is completely closed for unauthorised traffic during week days between 6.30 and 18.00, and Saturdays from 14.00 to 18.00. The area houses 42,000

residents, 12 ministries, municipality offices and corporate headquarters as well as the main tourist sites.

The strategy for Rome's Traffic Master Plan is to discourage or prohibit the use of private vehicles in the core and gradually relax these restrictions outside the area. (CURACAO project)

Since 2001 the traffic is regulated by 22 electronically monitored gates of entry, Access Control System, and a flat-fare Road Pricing scheme with an automatic control system called IRIDE. The technologies used are TV cameras and infra-red illuminators, microwave transponders and On-board Unit with Smart Card. The authorised vehicles have a magnetic code and are thus not photographed. A separate control is made in the data system before sending out fines. The fine is € 68 and the maximum is one fine a day. It is also possible for authorised vehicles to purchase a day-pass for € 20. Two-wheeled vehicles are not yet included in the scheme, since the present technology does not allow their recognition.

Excluded from the charge are residents of the area, taxis, service vehicles, disabled non-residents and public transport. Freight deliveries are allowed certain hours, mostly in the mornings. Those who have businesses in the area can purchase a permit for the equivalent of a year's pass on the public transport, the permits are paid annually.

Currently access permits have been issued to some 250 000 vehicles (about 12% of the total vehicles registered in Rome). Results show a 10% decrease in traffic throughout the day, 20 % decrease during the restriction period, 15% decrease in the morning peak hour (8.30-9.30), 10% increase in two-wheelers, and a 6% increase in public transport. (CURACAO-project) The reduction in dBA Leq 24 h is not high from this traffic reduction but the disturbance caused by traffic noise may still be decreased.

The Limited Traffic Zone (LTZ) was extended on a trial basis in 2004 to the Trastevere district and has become permanent since July 2006. A similar trial was carried out in the San Lorenzo district and implementation of the Access Control System began in 2006. The scheme is constantly being developed and new areas are included.

No evaluation on noise effects has been found. The environmental effect that is evaluated is air pollution, in relation to the benzene directive.

For more information on the Limited Traffic Zone (LTZ):

www.progress-project.org/Progress/rome.html

www.civitas-initiative.org/measure_sheet.phtml?lan=en&id=38

4.3 NIGHT BAN ON HEAVY TRAFFIC

4.3.1 Example Pecs

The congestion in Pecs is the result of the last decade's rapidly growing number of cars. To preserve the World heritage site of the inner city, a car –free zone was established through the Civitas project.

The zone is only open for cars owned by the local residents or relatives of physically disabled people who live in the area. Access permission cannot be purchased based on any other reason. Each family living in the car-free zone receives one free permit and pays a reduced fee for a second car. Annual permits can be bought but the demand is small due to a high price.

Within the World Heritage Zone, a speed-limit of 30 km/h has been introduced and access for heavy freighters (6 tonnes) has been limited.

The result is substantially reduced traffic. Some parts of the inner city have no traffic at all and other parts experience an 80% reduction. The reduction of heavy freighters in the inner city area is 95%. Pecs plans to extend the car-free zone to the whole area inside the medieval wall by 2010.

The restrictions have public acceptance because of the sensitivity of the World heritage which was a strong argument.

There is a noise target on a reduction of 3 dBA. The noise pollution is monitored and the city claims that the objectives, including the noise objective, are fulfilled. If you reduce traffic by 80% you can expect a noise reduction of appr. 7 dBA so the noise objective seems to fulfilled with a margin.

4.4 COSTS AND BENEFITS

Access restriction may of course be expensive to implement because of other measures that have to be taken. Examples can be new parking lots, public transport and system to enforce the restriction. On the other hand the measure is extremely efficient. The efficiency depends on to what extent the restrictions are taken. If you completely eliminate the traffic you obviously also completely eliminate the traffic noise.

5 PUBLIC TRANSPORT

When people travel with public transport, instead of their own car, several advantages are won. Public transport is generally more energy efficient, less air polluting, needs less space and is less noisy. Naturally the public transport can be a source of noise in it self. Different noise mitigation measures at the public transport can be most important. That problem is not further dealt with in this report. Please see www.qcity.org for more details about that.

The proportion of people travelling by public transport depends on several factors. Some obvious ones are availability, cost, total travel time, reliability, comfort and capacity, compared with alternative means of transport.

Some ways of making public transport more popular are

- Favourable charges and integrated fares – smart cards are a tool for integrating fares.

- Online trip planning, informing on the fastest route and a variety of options. Real-time information concerning delays in traffic, arrival time for next train/bus at bus stops as well as stations.

- Capacity increase by expansion of infrastructure, rail bound traffic and bus lanes and high level of departures.

- Bike-and-ride – The bus is equipped with external bike carriers and the bikes are loaded at designated stops. Commuter trains may offer the service of carrying bikes off- peak hours, alt. on certain lines or parts of lines.

- Travel guarantee. Travellers are offered compensation if traffic disruptions cause a delay of more than 20 minutes, for example. This system is used by Stockholm Public Transport and costs 3-4 million SEK/ year. The way it works is that if there is a delay that is exceeding, or is expected to exceed 20 minutes the transport company retrieves the cost for a taxi journey that replaces the journey with public transport. The traveller has to pay for the taxi herself and then claim for compensation.

- Comfort. Good lighting, comfortable seats, coffee and papers at the stations, information about train/ bus arrivals and delays, escalators and lifts, adequate seating at stations etc are also important factors. (Transek, synergieffekter av ekonomiska styrmedel och infrastruktur för minskad trängsel och miljöpåverkan, 2003).

One measure that may be argued not to be a public transport is the "Walking bus". What is meant with that is that children walk to school in a group accompanied by one or more adult. The "bus" walks along a safe route and picks up children on the way at designated meeting points. The main advantage is that it increases the safety of the children, primarily by preventing the parents from driving them to school and thus becoming a safety risk for the other children. It also helps stop congestion at schools in the morning. Naturally the air and noise emissions are reduced radically and the cost is

very low. Compared to an ordinary bus or the cost for driving the parents' cars the cost is even negative.

5.1 COSTS AND BENEFITS

The initial costs for building up a good public transport may be very high, particularly when it comes to rail bound traffic. However the investment pays off in the long run. One factor that indicates that is that the real estate situated near stations become popular and more valuable. A determining factor is that the amount of travellers is high enough to make the investment profitable.

Smaller measures to increase the popularity of the public transport are much less expensive but the range of costs is of course very large.

One advantage regarding the noise aspect is that the noise source is more concentrated and therefore easier to take care of at, or near, the source. A bus or a train is noisier than a passenger car but on the other hand it transports much more people so the noise emission per capita is smaller. Noise abatement measures at the public transport may be necessary. There are lots of noise complaints regarding public transport coming in to environmental authorities. The amount of complaints regarding the general road traffic is however higher.

6 PARKING

Many ways of influencing the parking situation have been tried around the world and over time. Some of these are

- Area zones. Parking places in inner city are expensive and have a limited parking time, adjacent to inner city they are moderately priced while distant parts of the city centre have low fees and outside the city centre they may be free.

- Time of day. To discourage long-term parking by solo commuters through peak parking surcharges.

- Calender day, distinguishes between weekday commuter parking and weekends.

- Duration of stay, encourages short-term parking and offers more free parking spaces. Drivers don´t need to drive around in search of parking. It also gives incentive for commuters to use parking lots designated for long-term parking.

In Pécs, Hungary (see chapter 4.3.1), the new parking zones were introduced and the traffic has been reduced, largely because it is easier to find a free parking place instead of earlier when many cars drove around in search of parking. Travel with public transport has increased and the extra revenues from the parking fees and the public transport are spent on modernizing the public transport fleet. See www.trendsetter-europé.org/index.php?ID=864. In general, car use in urban areas with expensive parking become less attractive to many motorists, in combination with limited parking space, travellers are stimulated to switch from private cars to the use of public transport.

It is important that the private parking spaces integrate with the charge scheme. Parking schemes are difficult to implement when there is a considerable amount of parking space available. To avoid urban sprawl and relocation of shopping centres outside the cities it is important to keep the charges within a reasonable amount.

(Policy guidelines for road transport pricing, United Nations Economic and Social Commission For Asia and the Pacific, ST/ESCAP/2216)

Control of parking benefits – Many workplaces supply parking spaces for their employees, this of course encourages the use of private cars. By restricting the use of parking spaces to apply to visitors only or introducing a scheme where the employees have the sum of the parking space deducted from the wage many will chose alternative modes of travel.

Good parking facilities. In a study made by The Royal Institute of Technology in Stockholm, KTH, security is an important factor for whether a parking lot is an option. Security for the vehicle as well as the persons is ranked highest, followed by regularity of busses or trains and that the parking is free of charge. Service at the park and ride lots is not as highly rated. The distance between the public transport and the parking lot is one of the major disadvantages, followed by difficulty in finding the facility.

Other factors to bear in mind are signs for directions to the lot, amount of vacancies, bus/train departures, travel time from start to goal etc.

Park and ride. Parking lots adjacent to the public transport nodes are important to bring down the total amount of travelled kilometres and thus the environmental impact. The parking lots may free of charge or subsidised or in connection with rebates on the public transport system. During the Stockholm congestion trial, the parking lots owned by the city's parking company were free of charge if the driver had a valid public transport card. The parking lots owned by Stockholm Transport are generally free of charge for all vehicles.

In the German town of Bremen the authorities ensure that car use plus charges in the city should not cost less than the cost of using public transport. Coupled with other parking measures like area zones urban transport has changed. According to a survey 50 % of all trips to the city centre are made by public transport, and roughly 22 % by bicycle.

Ex from Beginenhof, Bremen :

- Only a third of the normal amount of parking spaces per flat.
- The car owners have to rent a garage space for 65 € a month
- Access to car pool "Cambio Car" by the entrance to the residential area.
- Common public transport cards that can be used by different persons 24 hours a day.

http://www.mobilitymanagement.se/pdf/rapp_brem_o_gron.pdf

In Seoul, Korea, parking for residents is differentiated according to the scheme "all day" (most expensive), "daytime only" (3/4 of the price), and "night-time only" (half the price). (Policy guidelines for road transport pricing, United Nations Economic and Social Commission For Asia and the Pacific, ST/ESCAP/2216)

6.1 COSTS AND BENEFITS

The possibilty to influence the environmental impact from passenger cars via the parking policies are substantial. By localising the parking lots to places where they do not disturb the surroundings, directly or by traffic to and from the lots, a good effect may be achieved. Naturally the parking lots still have to be situated at convenient places for the motorists so they are actually used. It is also a good idea, at least from the environmental aspect, to concentrate the parking places to avoid traffic driving around searching for free parking places.

By different strategies for the pricing the use of the parking lots may be influenced in the desired way.

A comprehensive view is important. Different parts of the traffic apparatus have to fit together. If it is hard to find a parking place, or expensive to pay for one, there has to be other ways of reaching the destination, or cheaper ones.

The costs for introducing schemes to decrease the environmental burden, including the noise, are small. If new parking lots have to be built, e. g. near public transport nodes the costs may rise significantly.

7 BICYCLE INFRASTRUCTURE

Bicycles are very silent, almost completely silent. They are also energy efficient, not polluting the air, space efficient and they promote the health. A quantification of the noise reduction that is achieved by increasing the proportion of travellers on bicycle is hard to do. However every car that is replaced by a bicycle makes the surroundings less noisy. If you can make half of the motorists change to bicycle you get a reduction of 3 dB L_{eq} which may decrease the disturbance significantly.

The proportions of bicyclists vary a lot between different cities. A lot of the factors influencing the proportion can be altered by traffic authorities. The amount of hills and the weather are hard to adjust but for instance a well functioning snow clearing of the bicycle paths can be valuable.

Important factors to promote bicycling are parking facilities and safe bicycle paths. It is also important to allow the bicycles to go the shortest way between two points. For instance one-way streets and pedestrian streets should have bicycle paths, if possible.

Examples of well functioning bicycle facilities are found in the Netherlands. There as much as 30 % of the train passengers arrive at the stations by bike and approximately 10 % leave by bike and the numbers are growing. The bicycle parking facilities at the stations are run by the same company that runs the stations. Dutch experience shows that the demand for unguarded and guarded bicycles is about the same. The unguarded facilities consist of bicycle racks with standard coverings. Smaller stations have bicycle lockers and large stations have buildings where there are numerous racks. The smaller stations provide operators during peak hours and at other times bikes can be retrieved by an automatic access system. The larger stations have staff from the first to the last train.

Some good examples also come from Bremen, Germany:

- Separate bicycle lanes in another colour
- Coloured bicycle lanes
- One-way streets open for cyclists coming from opposite direction
- Separate right turn lanes for cyclists at traffic lights
- Boxes for cyclists in front of the cars stop line at traffic lights
- Roundabouts with clearly marked bicycle paths

www.mobilitymanagement.se/pdf/rapp_brem_o_gron.pdf

For more information on how to optimize the infrastructure for bicycling, see www.velomondial.net.

7.1 COSTS AND BENEFITS

The costs for constructing bicycle paths and parking facilities for bicycles may seem high. Compared with the alternative, similar facilties for cars, the costs are much smaller.

Some important action may be taken at neglectable costs. Examples are painting of separate lanes for bicycles, e. g. at one way streets.

The benefits from an increased proportion of cyclists are obvious. Less noise, less air pollution, less land use, better public health and so on.

8 LOGISTICAL CENTRES FOR CO-ORDINATED TRANSPORTS

Since 1 November 2006, in Stockholm, the distribution and delivery of the city's goods was to be handled by one transport company. The goods were delivered to a logistical centre where they were packed into smaller vehicles and distributed in a co-ordinated distribution net. All the vehicles were "clean" and specially equipped to handle limit values for emissions, and size (not larger than 3.5 tons). Initially approximately 10% of the goods were to be distributed in this way and by 2010 all the goods would be using this means of distribution.

There has not been made any evaluation according to the noise aspect. In a study made by the National Road Administration (Samordnade varuleveranser inom Stockholm stad, Vägverket publikation 2008:71) a reduced traffic work of 40% is absolutely possible and an even greater reduction is possible. The figure refers to the traffic work needed to distribute goods to all the activities operated by the city.

Since May 2008 this agreement is cancelled. The reason for the cancellation is said to be that the base became too small after an increasing number of schools, kindergartens and so on were privatized. These private businesses did for some reason not want to be included in the project.

By setting up logistical centres the municipalities can separate the transports from the distribution agreements by arranging for a coordinated local distribution network with a local road carrier. Environmental demands can be made on the trucks on threshold values for noise, emissions and size. The business has the advantage of keeping stock in bulk and having goods delivered at hours when the traffic is less busy.

The city of Stockholm has good experience for logistical centres. The idea with a local logistical centre was used when a new urban district was built in the beginning of this century. That district (Hammarby sjöstad) was specially designed to be environmental friendly and the logistical centre was a part of that. However, it showed that the centre made the construction more practical and cheaper as well.

There are many examples of logistical centres, also called consolidation centres, freight transfer centres etc. For more information, see www.bestufs.net .

8.1 COSTS AND BENEFITS

Again we have a measure that needs some investment before it starts to pay off. The investment does not have to be big if already existing facilities may be used for the centre. The costs may be cut after a short while so there is no need to wait a long time for the economic benefits.

How big the environmental improvement may be depends on how important the distribution of goods is when it comes to air pollution and noise emission. Even if the

equivalent levels of dB are not reduced very much, the reduction of heavy vehicles may be important to decrease the disturbance from the traffic noise.

9 TRAFFIC MANAGEMENT

Traffic management is to monitor the traffic situation in real-time and redirect it for the best possible flow. In case of congestion, accidents, flooding, road work etc. Collecting the information from different sources and systems to plan, predict and control the traffic reduces congestion, emission and traffic volume.

Advanced traffic signals and high service bus routes are examples of traffic management. In Stockholm priority for buses at intersections involves a system based on computers at major traffic intersections that optimise the priority for every bus arriving at the traffic lights. A system for predicting and managing the traffic has been introduced with the use of several data sources that are connected to a control system. The speed for busses has increased as well as the number of trips with public transport.

9.1 COSTS AND BENEFITS

Building a traffic management system can be difficult, and therefore expensive, because of the number of stakeholders involved and the complexity of the technical system. This is the case in Stockholm and Graz, two of the cities in the Trendsetter project.

The benefits are a better working traffic which causes fewer disturbances.

10 OTHER MEASURES

Eco Driving. There is a possibility for municipalities and other to educate their employees in green driving "eco-driving" for a smoother and quieter driving which is more fuel efficient as well as reducing noise emissions. Low and even speeds create less noise and with smoother driving the vehicle can reduce noise levels with 5 dB units compared to a more aggressive mode of driving. (SIKA PM 2005:11) The noise emission could probably be even lower if the green driving mode abolished the quick accelerations. However the fuel consumption would then not be optimized.

Cities, councils and other large actors have the opportunity to make demands when procuring for their fleet of cars. Hybrid-electric cars are much quieter than regular and demands may also be applied on the tyres of the cars to decrease the noise emission even more.

There are good examples from Sweden where several cities have worked together and purchased new vehicles with environmental friendly engines, and have pushed technology forwards by the demands.

Making special demands during procurement will of course increase the prize. The potiential for benefits is on the other hand important. It can also be argued that if nobody makes demands during procurement the techological developments will be slower.