Indicator Fact Sheets

GÖTEBORG

Issued in November 2005

Indicator Fact Sheets

List of indicators

TELLUS objective	Indicator	Unit of the indicator
Reduce congestion	Traffic flow	Number of vehicles per 24h Heavy traffic share
	Average speed	km/h
Reduce NOx emissions	NOx emissions	t/a
Reduce air pollution	Level of CO	mg/m³
	Level of NO_2	µg/m³
	Level of PM_{10}	
	Level of benzene	
Reduce traffic related CO_2 emissions	*CO_2 emissions*	*t/a*
Reduce noise	Noise level	Number of inhabitants exposed to noise levels >65dBA
Reduce traffic related energy use	*Primary energy use*	*TJ/a*
	Final energy use	*TJ/a*
	Type-specific final energy use	*TJ/a*
Reduction of road casualties and injured persons	*Fatalities, road accident-related injuries*	*Total number*
Increase the modal share in favour of public transport	*Average modal split*	*Percentage of trips (or vehicle kilometres or passenger kilometres)*
Reduce car kilometres	*Car kilometres*	*Total number*
Increase of public transport use	*Passenger kilometres*	
	Passengers	
Improvement of intra-organisational co-operation at the city level	Quality of intra-organisational co-operation	Qualitative terms
Improvement of public-private co-operation	Quality of public-private co-operation	Qualitative terms
Achievement of political and public awareness	Media exposure	Qualitative and quantitative terms
	Events organised	
	Presentations given	

Objectives in italics are not evaluated in Göteborg.

Methodology sheet: Indicator Fact Sheet

TELLUS objective evaluation
Indicator Fact Sheet for TELLUS objective "reduce congestion"
TELLUS Key Indicator: mean journey time between given locations
(trip-related congestion measures)
Derived indicator: average speed between given locations

Context, Description of the indicator

The indicator "mean journey times" is appropriate to measure the phenomenon congestion. The longer the mean journey time between two given locations is, the lower the flow of traffic and the average speed.
The unit of observation is the trip. The quality of the transport system is described by the effects of congestion on travel conditions. The measure refers to the congestion experienced by users and includes the duration of waiting, and the total trip time due to congestion. The rationale of taking the trip as the relevant unit of analysis is that trip-making behaviour such as route choices and mode and departure-time choices are based on the characteristics of the entire trip.
The mean journey time between given locations yields the average speed on the selected routes.

Unit of the indicators

Number of vehicles per 24h
Heavy traffic share
Km/h

Indicator-related objectives

Reduce congestion by 5% until 2006
Reduce congestion by 10% until 2010

Critical aspects of the objectives

The road congestion problem is an example of a self-reinforcing process with feedback loops stimulating car use. Policies aimed at reducing road traffic congestion and improving speeds lead to a further proliferation of the system. Therefore any congestion policy should contain travel speeds within economically tolerable limits.
Less congestion expressed by lower journey times and increasing average speeds means to make travelling by car more attractive.
More car use because of decreased journey times means more negative effects on environment-related, social-related, mobility behaviour-related and road traffic-related objectives. Hence the achievement of the TELLUS objectives becomes more difficult.

Methods of measurement

Traffic flow is measured in 12 fixed points. Mobile measurements are done to complement the results. The results from measurements in 3 of the fixed points are presented here. Measurements between given locations are not available. The location of the points are shown on a map in Appendix 1.

Source of data and analysis

Data is provided and analysed by The Traffic and Public Transport Authority.

Time table to collect and analyse the data

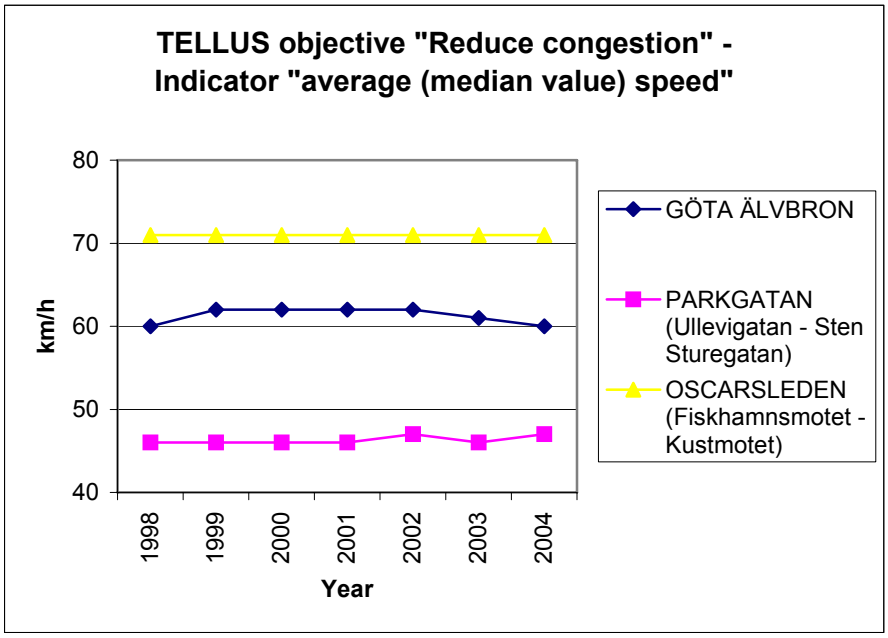
Retrospective view: From 1970, the data is collected and analysed yearly.

Development of the indicator value

Average number of vehicles during 24 hours (heavy traffic share in brackets):

	1998	1999	2000	2001	2002	2003	2004
GÖTA ÄLVBRON	26 100 (8%)	26 400 (7%)	26 200 (7%)	26 800 (7%)	26 000 (6%)	25 500 (6%)	26 100 (6%)
PARKGATAN Ullevigatan – Sten Sturegatan	16 300 (5%)	17 000 (5%)	16 500 (6%)	16 500 (5%)	17 000 (6%)	16 600 (5%)	17 200 (4%)
OSCARSLEDEN Fiskhamnsmotet - Kustmotet	45 000 (9%)	45 700 (9%)	45 700 (9%)	44 400 (9%)	46 800 (8%)	43 600 (8%)	42 600 (8%)

Average speed (median value) during 24 hours[1]*:*



Analysis

No significant change has been detected in vehicle speed during the period and thus it is not possible to assess whether congestion has increased or decreased. A slight reduction of traffic flow can be seen at two of the measuring points (Göta Älvbron and Oscarsleden), it is however not yet possible to assess whether this is a real trend since both points are affected by the construction of a new city-

[1] Traffic and Public Transport Authority of Göteborg (2005)

centre tunnel, Götatunneln. At the third measuring point, Parkgatan, an increase in traffic flow can be noticed, but since the vehicle speed has not changed significantly, it is not possible to assess any change in congestion.

Relation to other indicator systems

Study (institution or country)	**Proposed Indicator with regard to the issue**
METEOR (EU: CIVITAS Initiative)	Daily trip length (peak and off peak). Average vehicle speed (peak and off peak).
TERM	Average journey length and time per person, by mode and purpose (work/education, business, shopping, leisure, holidays).
EST	-
CSD	-
NFP (Switzerland)	-
BPI/PRR	-

References

Traffic and Public Transport Authority of Göteborg (2005): “Statistik över biltrafikflödena på Göteborgs gator och vägar.“, www.trafikkontoret.goteborg.se.

Methodology sheet: Indicator Fact Sheet

TELLUS objective evaluation
Indicator Fact Sheet for TELLUS objective "reduce NOx emissions"
TELLUS Key Indicator: NOx emissions

Context, impacts

As a result of the introduction of catalytic converters NOx emissions of the transport sector fell significantly during the last years. Nevertheless the transport sector is the main polluter of NOx and its percentage of the total NOx emissions increases continuously.
NOx emissions are an important contributor to acid rain, acid deposition, and eutrophication, which can alter the ecosystems of water bodies, forests and meadowlands. In addition to local and regional effects, NOx emissions can have global effects in that nitrogen oxides can contribute to global warming, directly and indirectly. In Europe, transportation accounts for 60% of NOx emissions.[2]
In many parts of Europe, critical loads for acidification and eutrophication are exceeded by a factor of two to four, indicating that ecosystems are at risk of being damaged and their sustainability endangered.[3] Consideration of depositions of nitrogen compounds across Europe in relation to critical loads has indicated that for many areas even reduction of NOx emissions from transportation to zero would not be sufficient to meet critical loads for deposition of nitrogen compounds in many areas. Critical levels for ozone would also be exceeded.[4]
Because of the TELLUS objective "reduce NOx emissions from heavy traffic" the indicator "NOx emissions" relates primarily to heavy traffic. For the sake of completeness and comparability NOx emissions from the whole road traffic will be assessed.

Unit of the indicator

t/a

Indicator-related objectives

Reduce NOx emissions from heavy traffic by 5% until 2006
Reduce NOx emissions from heavy traffic by 10% until 2010

Methods of measurement

Levels of NOx emissions are calculated by estimating emissions from all sources of NOx emissions (traffic, industry etc).

Source of data and analysis

The Environmental Office of Göteborg collects and analyses the data.

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[2] OECD 1999, p. 13.

[3] A critical load has been defined as "the highest deposition of a compound that will not cause chemical changes leading to long-term harmful effects on ecosystem structure and function."

[4] OECD 1999, p. 21

Legal basis, standard values, political objectives

National directives

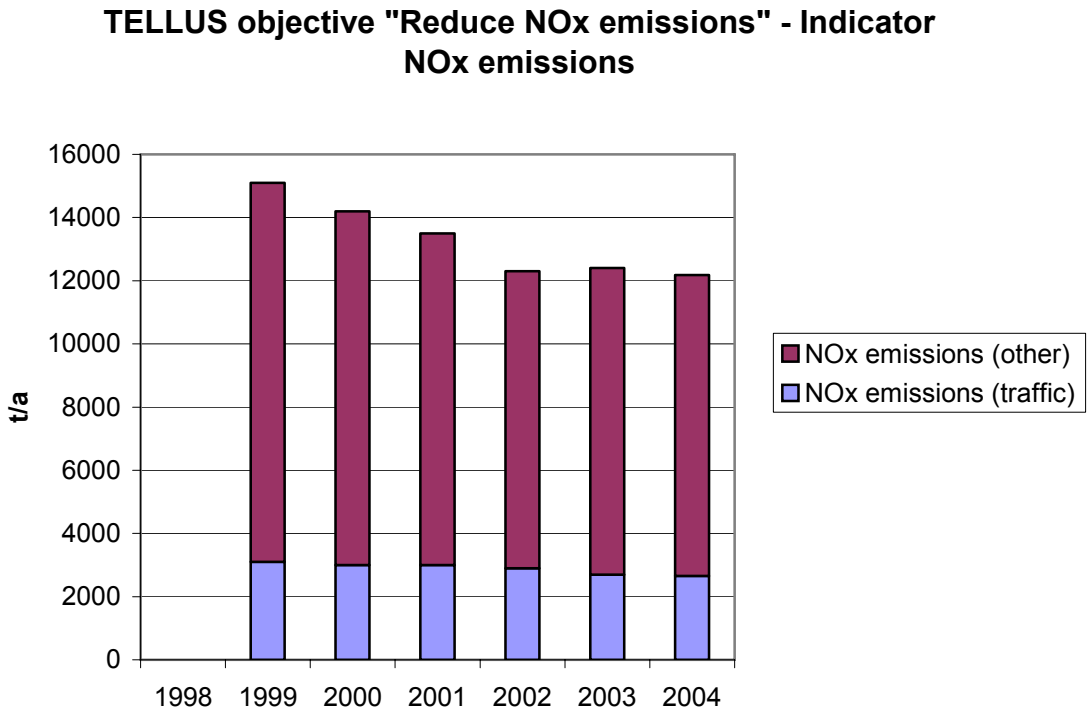
By 2010, nationwide NOx emissions to air, calculated as NO_2, are to be reduced to 140 000 t/a. In 2001, nationwide NOx emissions to air, calculated as NO_2, were 251 000 t.

Time table to collect and analyse the data

Retrospective view: The emissions are calculated yearly.

Development of the indicator value

The graph below shows the calculated NOx emissions in Göteborg, traffic related and total emissions[5].



Analysis

Total NOx emissions are decreasing quite rapidly (-20% in five years), but traffic related emissions are decreasing very slowly. This is probably due to the fact that lower emissions from the average vehicle are balanced by a higher total number of vehicles.

[5] Environmental Office of Göteborg 2003

Relation to other indicator systems

Study (institution or country)	**Proposed Indicator with regard to the issue**
METEOR (EU: CIVITAS Initiative)	NOx emissions (NOx per vkm (g/km) derived)
TERM (EU: European Environment Agency)	NOx emissions (t/a)
EST (OECD)	NOx emissions
CSD (Germany)	NOx emissions (t/a)
NFP (Switzerland)	Nox emissions (t/a)
BPI/PRR	-

References

Environmental Office of Göteborg(2004): Miljörapport för 2003. En beskrivning av miljötillståndet i Göteborg, R 2004:5.

Environmental Office of Göteborg (2005): Miljörapport för 2004. En beskrivning av miljötillståndet i Göteborg, R 2005:9.

OECD, Dist.: 24-Sep-1999: Environmentally Sustainable Transport. Final Report on Phase II of the OECD EST Project. Volume 1: Synthesis Report.

SNFS 2001:527 Förordningen om miljökvalitetsnormer.

Methodology sheet: Indicator Fact Sheet

TELLUS objective evaluation
Indicator Fact Sheet for TELLUS objective "Reduce air pollution "
Indicator: level of CO

Context, impacts

The transport sector is a major source of air pollution, and the dominant source in urban areas. Exposure to air pollution can cause adverse health effects, most acute in children, asthmatics, and the elderly, and can damage vegetation and materials (notably, the cultural heritage).
Within the transport sector, road traffic is the most important contributor to urban air pollution. While national and EU regulations aimed at automobile emission reductions have resulted in considerably lower emissions per vehicle, the continuous expansion of the vehicle fleet is partly offsetting these improvements.[6]
CO is produced by the incomplete burning of carbon in fuels. High concentrations of CO occur along roadsides in heavy traffic, particularly at major intersections. The health effects of CO vary depending on the length and intensity of exposure and the health of the individual. Effects of CO include dizziness, headache, fatigue, visual impairment, reduced work capacity, reduced manual dexterity, and poor learning ability.[7]

Unit of the indicator

mg/m³

Indicator-related objectives

Reduce air pollution to levels below national and EC directives until 2006

Critical aspects

Due to the low concentration levels of CO the air quality with regard to CO is no more a crucial issue.

Methods of measurement

Concentration measurements in Göteborg are carried out at 4 fixed measurement points (trend stations) and 3 mobile measurement stations. Non-dispersive IR-detectors (NDIR) are used.

Source of data and analysis

The Environmental Office of Göteborg collects and analyses the data.

[6] EEA (2000), p. 27.
[7] METEOR (2002), Annexes

Legal basis, standard values, political objectives

Directive 2000/69/EC of the European Parliament and of the Council

	Averaging period	Limit value	Margin of tolerance	Date by which limit value is to be met
Limit value for the protection of human health	Maximum daily 8-hour mean	10 mg/m^3	6 mg/m^3 on 13 December 2000, reducing on 1 January 2003 and every 12 months thereafter by 2 mg/m^3 to reach 0% by 1 January 2005	1 January 2005

National directives

	Averaging period	Limit value	Year by which limit value is to be met
CO	1 year	10 mg/m^3	2010

Time table to collect and analyse the data

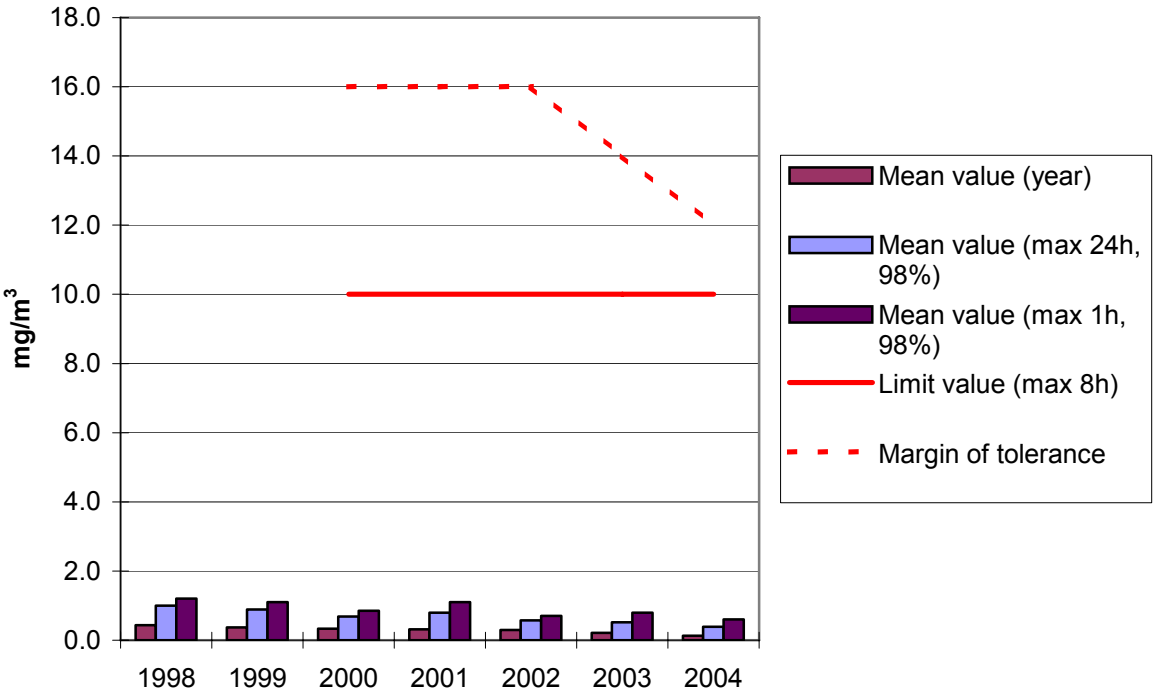
Retrospective view: From 1998, the data is collected and analysed yearly.

Development of the indicator value

The graph shows the mean value of CO-immissions at the measure station Femman[8]. The station is situated app. 30 metres up (on the roof of the building). Femman is chosen because it is the oldest and most reliable station. The location of the station is shown in Appendix 1.
The measured levels of CO in Göteborg are published as mean value for 1h, 24h and year. This corresponds with the national directives. Since the measured levels for all three values are well below the European Directive, which is based on 8h-mean, the European Directive is considered to be met.

[8] Environmental Office of Göteborg (2005)

TELLUS objective "Reduce air pollution - Indicator CO levels



Analysis

CO levels in Göteborg are at very low levels and decreasing, probably due to the fact that the number of older vehicles without catalytic converters is decreasing.

Relation to other indicator systems

Study (institution or country)	**Proposed Indicator with regard to the issue**
METEOR (EU: CIVITAS Initiative)	-
TERM	-
EST	-
CSD	-
NFP (Switzerland)	-
BPI/PRR (UBA Germany)	-

References

EEA: Are we moving in the right direction? Indicators on transport and environment integration in the EU. TERM 2000. Environmental issues series No 12. Copenhagen 2000.

Environmental Office of Göteborg(2005): www.miljo.goteborg.se/luftnet.

Issued in November 2005

METEOR (2002): WP4 Project Impact Evaluation. Task 4.1. Evaluation Guidelines
SNFS 2001:527 Förordningen om miljökvalitetsnormer.
SNFS 2003:112 Förordning om ändring i förordningen (2001:527) om miljökvalitetsnormer för utomhusluft.

Methodology sheet: Indicator Fact Sheet

TELLUS objective evaluation
Indicator Fact Sheet for TELLUS objective "Reduce air pollution"
Indicator: level of NO_2

Context, impacts

The transport sector is a major source of air pollution, and the dominant source in urban areas, having overtaken the combustion of high-sulphur coal, oil and industrial combustion processes.
Exposure to air pollution is associated with adverse health effects, most acute in children, asthmatics, and the elderly, and can damage vegetation and materials (notably, the cultural heritage).[9]
Within the transport sector, road traffic is the most important contributor to urban air pollution. While national and EU regulations aimed at automobile emission reductions (such as the introduction of catalytic converters or unleaded petrol) have resulted in considerably lower emissions per vehicle, the continuous expansion of the vehicle fleet is partly offsetting these improvements.[10]
Nitrogen oxides are produced whenever air is involved in high-temperature combustion processes. Exposure to NO_2 is associated with adverse health effects. Ambient nitrogen dioxide causes respiratory problems in humans and damage to plants.

Unit of the indicator

µg/m³

Indicator-related objectives

Reduce air pollution to levels below national and EC directives until 2006.

Methods of measurement

"Chemoluminiscense" is the method used for measuring NOx, NO_2 and NO in real time.

The fast reaction:

$$NO + O_3 \longrightarrow NO_2 + O_2$$

is done under emission of Chemoluminiscense light.

Source of data and analysis

The Environmental Office of Göteborg collects and analyses the data.

[9] METEOR (2002), Annexes
[10] EEA (2000), p. 27.

Legal basis, standard values, political objectives

EU directive

Council Directive 1999/30/EC

	Averaging period	Limit value	Margin of tolerance	Date by which limit value is to be met
Hourly limit value for the protection of human health	1 hour	200 µg/m3 NO2, not to be exceeded more than 18 times a calendar year	50% on the entry into force of this Directive, reducing on 1 January 2001 and every 12 months thereafter by equal annual percentages to reach 0% by 1 January 2010	1 January 2010
Annual limit value for the protection of human health	Calendar year	40 µg/m^3 NO_2	50% on the entry into force of this Directive, reducing on 1 January 2001 and every 12 months thereafter by equal annual percentages to reach 0% by 1 January 2010	1 January 2010

National directives

	Averaging period	Limit value	Year by which limit value is to be met
NO_2	1 hour	90 µg/m³	2006
	24 hours	60 µg/m³	2006
	1 year	40 µg/m³	2006

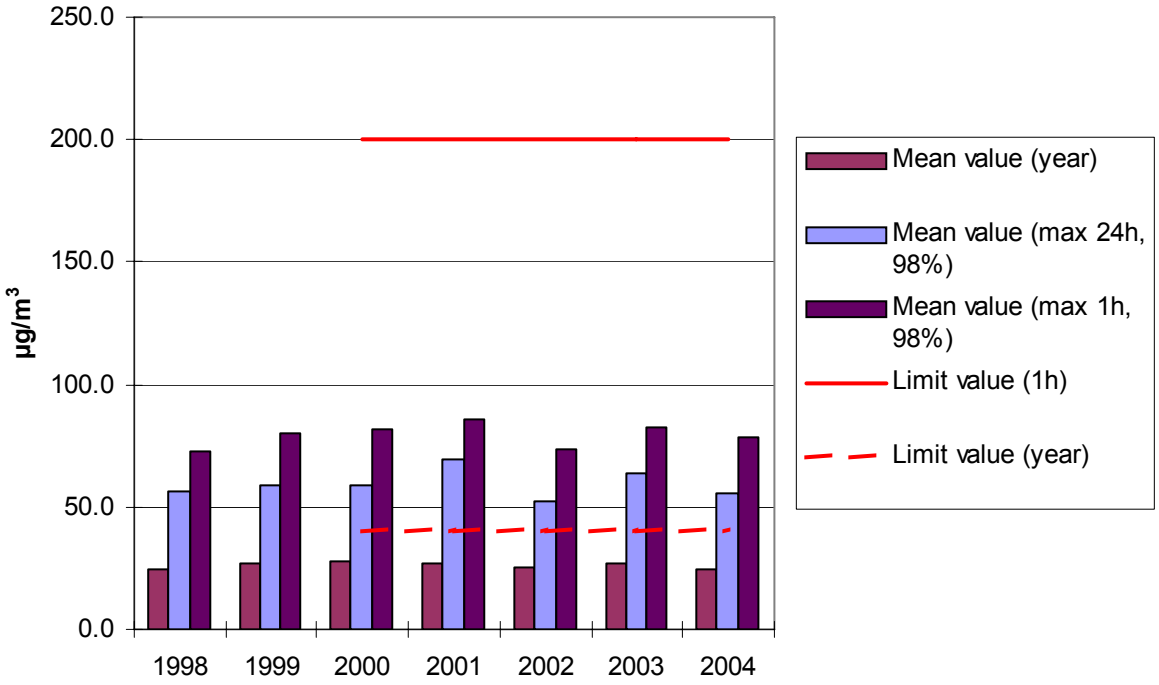
Time table to collect and analyse the data

Retrospective view: From 1998, the data is collected and analysed yearly.

Development of the indicator value

The graph shows the mean value of NO_2-immissions at the measure station Femman. The station is situated app. 30 metres up (on the roof of the building). Femman is chosen because it is the oldest and most reliable station. The location of the station is shown in Appendix 1.

TELLUS objective "Reduce air pollution - Indicator NO_2 levels



Source: Statistics from the Environmental office of Göteborg

Analysis

NO_2 levels in Göteborg are below the limit values. Levels are however not decreasing. This is probably due to the fact that lower emissions from the average vehicle are balanced by a higher total number of vehicles. The levels measured at Femman are probably mostly traffic related and since traffic is increasing no real decrease in NO_2 levels can be expected.

Relation to other indicator systems

Study (institution or country)	**Proposed Indicator with regard to the issue**
METEOR (EU: CIVITAS Initiative)	NOx levels (NOx concentration on an annual basis, in ppm or g/m³)
TERM	-
EST	-
CSD	-
NFP (Switzerland)	NOx level at the places of residence (% excessively burdened people)
BPI/PRR (UBA Germany)	Percentage of inhabitants exposed to NOx levels under 25 µg/m³, resp. percentage of road length

References

Environmental Office of Göteborg (2004): Miljörapport för Göteborg 2003.
METEOR (2002): WP4 Project Impact Evaluation. Task 4.1. Evaluation Guidelines
SNFS 2001:527 Förordningen om miljökvalitetsnormer.
SNFS 2003:112 Förordning om ändring i förordningen (2001:527) om miljökvalitetsnormer för utomhusluft.

Methodology sheet: Indicator Fact Sheet

TELLUS objective evaluation
Indicator Fact Sheet for TELLUS objective "Reduce air pollution"
Indicator: level of PM_{10}

Context, impacts

The transport sector is a major source of air pollution, and the dominant source in urban areas. Exposure to air pollution can cause adverse health effects, most acute in children, asthmatics, and the elderly, and can damage vegetation and materials (notably, the cultural heritage).
Within the transport sector, road traffic is the most important contributor to urban air pollution. While national and EU regulations aimed at automobile emission reductions have resulted in considerably lower emissions per vehicle, the continuous expansion of the vehicle fleet is partly offsetting these improvements.[11]
Particulate matter is primarily emitted by diesel engines. Because of the adverse health effects Particulate matter is the most severe air pollution problem affecting large cities. Particulate matter irritates the membranes of the respiratory system, causing increased respiratory symptoms and diseases like cancer.
Current trends show that gasoline is more and more substitute by diesel because of the higher energy efficiency.

Unit of the indicator

µg/m³

Indicator-related objectives

Reduce air pollution to levels below national and EC directives until 2006.

Critical aspects

EC directives are not sufficient to prevent serious health risks.

Methods of measurement

Direct measurement of particulate mass collected on a filter using tapered element oscillating microbalance (TEOM) technology.

Source of data and analysis

The Environmental Office of Göteborg collects and analyses the data.

[11] EEA (2000), p. 27.

Legal basis, standard values, political objectives

Council Directive 1999/30/EC.

	Averaging period	Limit value	Margin of tolerance	Date by which limit value is to be met
Stage 1				
24-hour limit value for the protection of human health	24 hours	50 µg/m^3 PM_{10}, not to be exceeded more than 35 times a calendar year	50% on the entry into force of this Directive, reducing on 1 January 2001 and every 12 months thereafter by equal annual percentages to reach 0% by 1 January 2005	1 January 2005
Annual limit value for the protection of human health	Calendar year	40 µg/m^3 PM_{10}	20% on the entry into force of this Directive, reducing on 1 January 2001 and every 12 months thereafter by equal annual percentages to reach 0% by 1 January 2005	1 January 2005
Stage 2(1)				
24-hour limit value for the protection of human health	24 hours	50 µg/m^3 PM_{10}, not to be exceeded more than 7 times a calendar year	To be derived from data and to be equuivalent on the Stage 1 limit value	1 January 2010
Annual limit value for the protection of human health	Calendar year	20 µg/m^3 PM_{10}	50% on 1 January 2005 reducing every 12 months thereafter by equal annual percentages to reach 0% by 1 January 2010	1 January 2010

(1) Indicative limit values to be reviewed in the light of futher information on health and environmental effects, technical feasibility and experience in the application of Stage 1 limit values in the Member States.

National directives

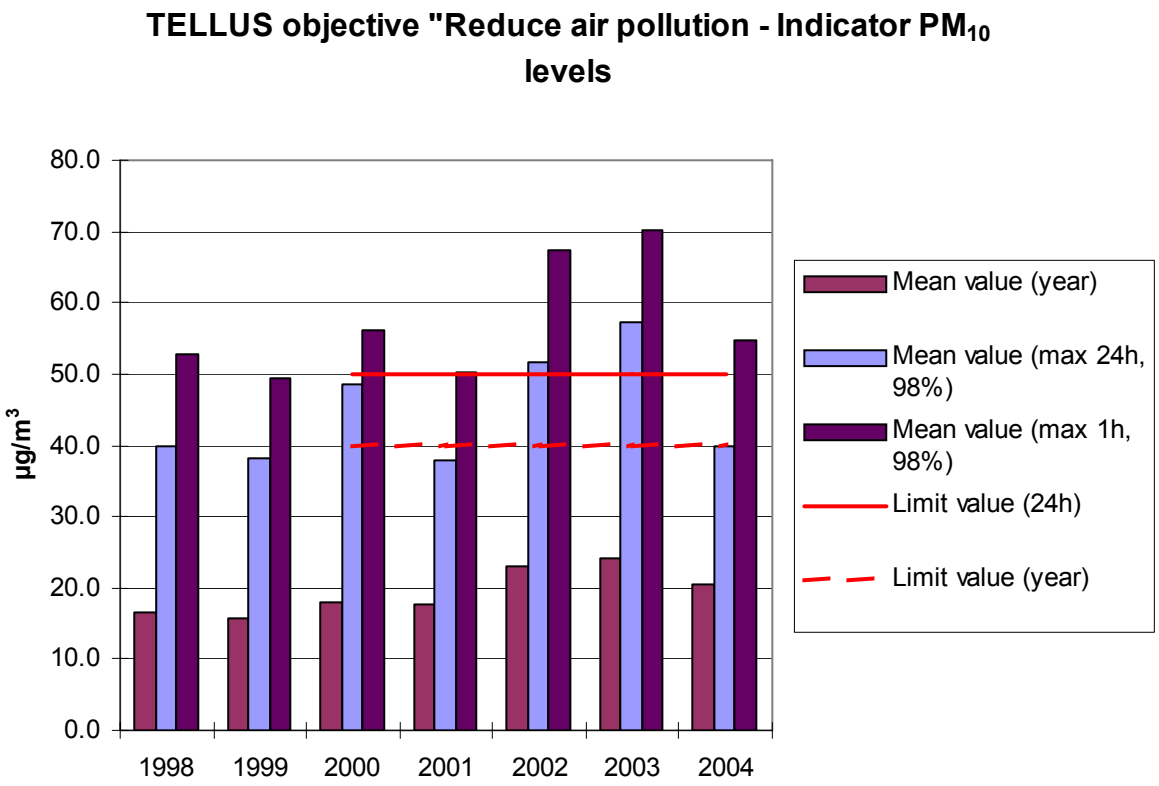
	Averaging period	Limit value	Year by which limit value is to be met
PM_{10}	24 hours	50 µg/m³	2005
	1 year	40 µg/m³	2005

Time table to collect and analyse the data

Retrospective view: From 1998 the data is collected and analysed yearly. The analysis is done by The Environmental Office in Göteborg.

Development of the indicator value

The graph shows the mean value of PM_{10}-immissions at the measure station Femman. The station is situated app. 30 metres up (on the roof of the building). Femman is chosen because it is the oldest and most reliable station. The location of the station is shown in Appendix 1.



Source: Statistics from the Environmental office of Göteborg

Analysis

Levels of PM are not decreasing, rather increasing at Femman. Most of the Particulate Matter probably originates from studded tyres, and the increase in traffic consequently results in higher PM levels.

Relation to other indicator systems

Study (institution or country)	**Proposed Indicator with regard to the issue**
METEOR (EU: CIVITAS Initiative)	Particulate levels (PM_{10} concentration on an annual basis, in ppm or g/m³)
TERM	-
EST	-
CSD	-
NFP (Switzerland)	PM_{10} level at the places of residence (% excessively burdened people)
BPI/PRR	-

References

EEA: Are we moving in the right direction? Indicators on transport and environment integration in the EU. TERM 2000. Environmental issues series No 12. Copenhagen 2000.

Environmental Office of Göteborg: Miljörapport för Göteborg 2003.

SNFS 2001:527 Förordningen om miljökvalitetsnormer.

SNFS 2003:112 Förordning om ändring i förordningen (2001:527) om miljökvalitetsnormer för utomhusluft.

Methodology sheet: Indicator Fact Sheet

TELLUS objective evaluation
Indicator Fact Sheet for TELLUS objective "Reduce air pollution "
Indicator: level of benzene

Context, impacts

The transport sector is a major source of air pollution, and the dominant source in urban areas. Exposure to air pollution can cause adverse health effects, most acute in children, asthmatics, and the elderly, and can damage vegetation and materials (notably, the cultural heritage).
Within the transport sector, road traffic is the most important contributor to urban air pollution. While national and EU regulations aimed at automobile emission reductions have resulted in considerably lower emissions per vehicle, the continuous expansion of the vehicle fleet is partly offsetting these improvements.[12]
Emissions of benzene occur when there is combustion of carbon compounds. Emissions are the result of incomplete combustion, spillage or evaporative emissions.
Benzene contributes to ozone formation, has direct toxic effects on humans and animals, including carcinogenesis and neurotoxicity, and is harmful to plants.
Emissions of benzene decreased during the last years significantly.

Unit of the indicator

µg/m³

Indicator-related objectives

Reduce air pollution to levels below national and EC directives until 2006

Critical aspects

Due to its carcinogenic properties there is no safe level for this pollutant. For carcinogenic substances total elimination should be the goal.

Methods of measurement

The levels of benzene are measured at two stations (Gårda and Haga) since 2002. The stations are situated near the street level.

Source of data and analysis

The Environmental Office of Göteborg collects and analyses the data.

[12] EEA (2000), p. 27.

Legal basis, standard values, political objectives

Directive 2000/69/EC of the European Parliament and of the Council

	Averaging period	Limit value	Margin of tolerance	Date by which limit value is to be met
Limit value for the protection of human health	Calendar year	5 µg/m^3	5 µg/m^3 (100%) on 13 December 2000, reducing on 1 January 2006 and every 12 months thereafter by 1 µg/m^3 to reach 0% by 1 January 2010	1 January 2010

National directives

	Averaging period	Limit value	Year by which limit value is to be met
Benzene	1 year	5 µg/m³	2010

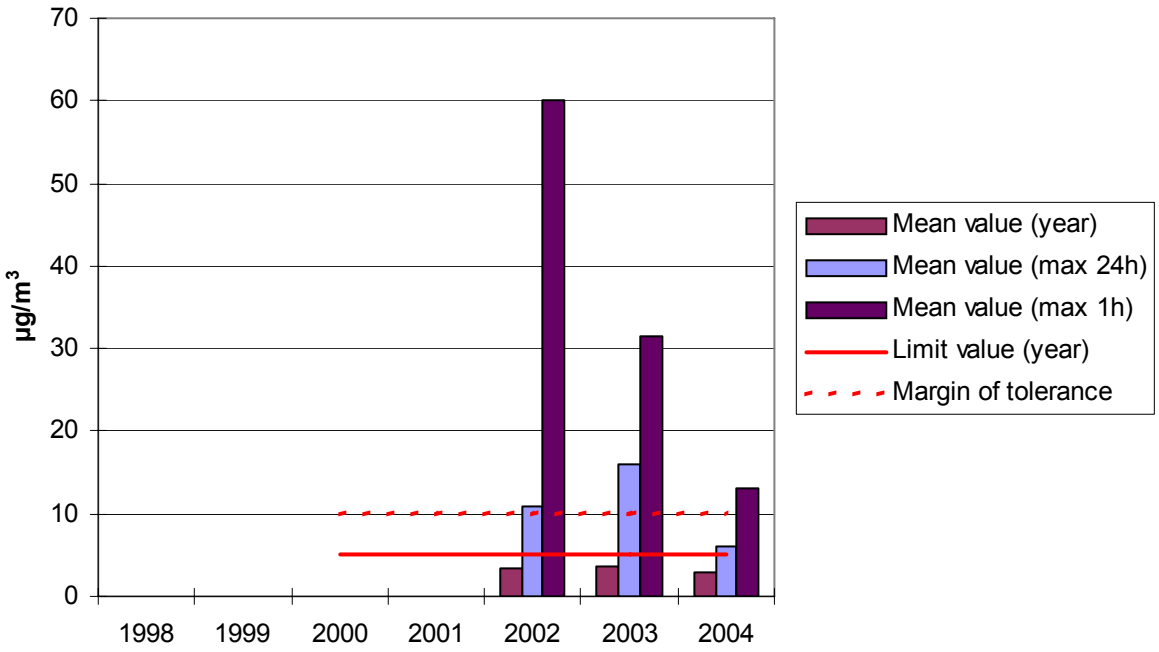
Time table to collect and analyse the data

Retrospective view: From 2003 until end of the TELLUS project, the data is generated monthly.

Development of the indicator value

The graph shows the mean value of benzene immissions at the measure station Gårda. Gårda is chosen because it is the more reliable of the two stations measuring benzene. The location of the station is shown in Appendix 1.

TELLUS objective "Reduce air pollution - Indicator benzene levels



Source: Statistics from the Environmental office of Göteborg

Analysis

Benzene levels have not been measured long enough to draw any conclusions on the trend of the development. Measured levels hourly and daily are still very uncertain and there might be errors in the results, especially for 2002.

Relation to other indicator systems

Study (institution or country)	**Proposed Indicator with regard to the issue**
METEOR	-
TERM	-
EST	-
CSD	-
NFP (Switzerland)	-
BPI/PRR	-

References

EEA: Are we moving in the right direction? Indicators on transport and environment integration in the EU. TERM 2000. Environmental issues series No 12. Copenhagen 2000.

Environmental Office of Göteborg: Miljörapport för Göteborg 2003.

SNFS 2001:527 Förordningen om miljökvalitetsnormer.

SNFS 2003:112 Förordning om ändring i förordningen (2001:527) om miljökvalitetsnormer för utomhusluft.

Methodology sheet: Indicator Fact Sheet

TELLUS objective evaluation
Indicator Fact Sheet for TELLUS objective "reduce noise"
Indicator: Noise level

Context, impacts

Noise levels caused by transportation present a health concern or serious nuisance. Noise affects people physiologically and psychologically: noise levels above 40 dBA can influence well-being, with most people being moderately annoyed at 50 dBA and seriously annoyed at 55 dBA. Levels above 65 dBA are detrimental to health (WHO, 1999).[13]

Traffic noise is the most important source of environmental annoyance. According to the Environmental Expert Council of Germany, severe annoyance consistent over prolonged periods of time is to be regarded as causing distress. Even during sleep the noise from traffic may be categorized as danger signals and induce the release of stress hormones. In accordance with the noise stress hypothesis chronic stress hormone dysregulations and increases of established endogenous risk factors of ischaemic heart diseases have been observed under long-term environmental noise exposure. Therefore, an increased risk of myocardial infarction is to be expected. The results of individual studies on this subject in most cases do not reach statistical significance. However, according to the Environmental Expert Council, they show a consistent trend towards an increased cardiovascular risk if the daytime immission levels exceed 65 dBA.[14]

According to experts noise levels from transport which do not impair health should be in all places below 65 dBA and in residential areas below 55 dBA during the day and below 45 dBA at night.[15]

Unit of the indicator

Number of inhabitants exposed to traffic noise levels above 65 dBA outside building (façade).

Indicator-related objectives

Reduce noise to levels below national and EC directives until 2006.

Methods of measurement

The Environmental Office in Göteborg does the calculations and measurements. Model calculation is carried out for 1600 places around Göteborg. 300 measurements complement the results.

Source of data and analysis

The Traffic and Public Transport Authority reports the noise levels at streets regularly. The Environmental Office collects and analyses the data.

[13] EEA (2000), p. 32.
[14] Hartmut Ising, Barbara Kruppa (2001), p. 181.
[15] OECD (1999), p. 23.

Legal basis, standard values

Sweden

Infrastrukturpropositionen 1996/97:53: Recommended limit values for noise levels from traffic:
30 dBA eqv. indoors
45 dBA max. indoors during the night
55 dBA eqv. outside building (façade)
70 dBA max. outside building (façade)

Time table to collect and analyse the data

Retrospective view: From 1997 until end of the TELLUS project, the data will be collected as often as results are available. The Environmental Office in Göteborg collects and analyses the data.

Development of the indicator value

Number of inhabitants exposed to noise levels (from traffic) >65dBA[16]

Year	**1997**	**1998**	**2002**
Inhabitants	15 000	12 000	10 500

Annotation

Number of people exposed to noise levels (from traffic) above 65 dBA during the day: 10 500 inhabitants. This is equivalent to 2% of the inhabitants in Göteborg.

[16] Traffic and Public Transport Authority of Göteborg & Environmental Authority of Göteborg (2003)

Relation to other indicator systems

Study (institution or country)	**Proposed Indicator with regard to the issue**
METEOR (EU: CIVITAS Initiative)	Noise perception (% of population exposed, broken down into 5 different perception bands of L_{day} and L_{night}, classification: absolutely dissatisfied, partly dissatisfied, absolutely satisfied, partly satisfied, neither satisfied nor dissatisfied)
NFP (Switzerland)	Noise level at the places of residence (% excessively burdened people)
BPI/PRR (UBA Germany)	Percentage of inhabitants exposed to noise levels under 65 dB(A) at days, percentage of inhabitants exposed to noise levels under 45 dB(A) at nights, resp. percentage of road length
TERM (EU: European Environment Agency)	% of population exposed to four transport noise exposure levels (in Ldn): <55 dB, 55-65 dB, 65-75 dB and >75 dB
EST (OECD)	Noise levels from transport
CSD (Germany)	Percentage of population troubled with traffic noise

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Methodology sheet: Indicator Fact Sheet

TELLUS objective evaluation
Indicator Fact Sheet for TELLUS objective "Improvement of intra-organisational co-operation at the city level"
Indicator: Quality of intra-organisational co-operation

Description of the indicators, relevance

A successful transport and environmental policy requires a good co-operation between the different stakeholders. With regard to TELLUS the risks that could affect a successful implementation of the demonstration measures could be reduced by a good co-operation between the relevant companies and institutions. The TELLUS objective "improvement of intra-organisational co-operation at the city level" refers to the quality of co-operation between the different partners within the TELLUS project in Göteborg. Not only the TELLUS project can benefit from an improved intra-organisational co-operation but also further projects in the field of sustainable transportation for example the development of integrated policy strategies for the transport sector.

Unit of the indicator

Qualitative terms
Analysis of interviews with key persons

Indicator-related objectives

Improvement of intra-organisational co-operation

Methods of measurement

Improved intra-organisation co-operation at the city level is interpreted as the co-operation between the different involved partners within the TELLUS project in Göteborg. Intra-organisational cooperation was evaluated using a questionnaire and interviews with key persons within the measures.

Source of data and analysis

The survey was carried out and analysed by an external consultant.

Development of the indicator value

Improved intra-organisational co-operation at the city level is interpreted as the co-operation between the different involved partners within the TELLUS project in Göteborg. Intra-organisational cooperation was evaluated using a questionnaire and interviews with key persons within the measures.
The co-operation between the different partners has increased and improved as a result of TELLUS. It is, however, not yet possible to quantify or to show concrete results of the increased co-operation. The co-operation has up to now primarily been within the TELLUS project, but already some external projects have been started and all repliers to the questionnaire believe that TELLUS will have a lasting and positive effect on co-operation even after TELLUS has been ended.

Several meetings and seminars have been held involving different partners, thus improving both the formal and informal co-operation, which will greatly benefit further co-operation. A non-neglectable part of the achievements within the measures can be related to the improved co-operation, since this has helped the measures promoting each other.
There have been continuous meetings during the TELLUS project where all partners have informed each other of the progress. After two years into TELLUS, in relation to the TELLUS amendment, four new partners were added to TELLUS in Göteborg. An informal mingle party, with representation by the deputy mayor, was arranged. This contributed to better knowledge and better cooperation on the local level and within the internal target group.

Time table to obtain and analyse the data

Survey and analysis at the end of the project in 2005.

Relation to other indicator systems

Study (institution or country)	**Proposed Indicator with regard to the issue**
METEOR (EU: CIVITAS)	-
NFP (Switzerland)	-
BPI/PRR (UBA Germany)	The indicator is a question which can be proved by a simple yes/no statement. The question with regard to intra-organisational co-operation is: Exists an integrated transportation development plan?
TERM (EU: European Environment Agency)	-
EST (OECD)	-
CSD (Germany)	- -

Methodology sheet: Indicator Fact Sheet

TELLUS objective evaluation
Indicator Fact Sheet for TELLUS objective "Improvement of public-private co-operation"
Indicator: Quality of public-private co-operation

Description of the indicators, relevance

New transportation concepts as well as new forms of vehicle use, new ideas for the distribution of goods or initiatives on clean fleets requires public-private co-operation. Public-private co-operation refers to any kind of co-operation between the public and the groups/companies/institutes in the private sector that are somehow involved in the project demonstrations.
The risks that could affect an effective implementation of the TELLUS demonstration measures as for example legal restrictions and obtaining permits necessary for the implementation can be reduced by a good public-private co-operation. Hence good public-private co-operation is a pre-requisite for a successful implementation of many TELLUS demonstration measures.

Unit of the indicator

Qualitative terms
Analysis of interviews with key persons

Indicator-related objectives

Improvement in qualitative terms

Methods of measurement

Analysis and summary of the interviews and surveys carried out within the TELLUS demonstration measures with identified key persons with regard to the quality of public-private co-operation. Topics of the interviews are the kinds of co-operation, improvements of the co-operation, instruments of the co-operation, problems, estimation of the maintenance of the co-operation etc.

Source of data and analysis

The analysis is carried out by the demonstrator contacts and summarised by an external consultant.

Time table to obtain and analyse the data

Survey and analysis of the data at the end of each demonstration measure.

Development of the indicator value

Public-private co-operation is, within TELLUS Göteborg, interpreted as the co-operation between the partners and the target groups. This co-operation has greatly improved, mainly due to the fact that this has been a major focus in many of the measures, since the belief is that it will not be possible to achieve good results unless the target groups are closely involved in the measures.

The objective “Improved public-private co-operation” is closely related to the objective “Achieve extensive political and public awareness for TELLUS”, and thus further elaboration is made in the Indicator Fact Sheet for TELLUS objective “Achievement of political and public awareness for TELLUS”.

Relation to other indicator systems

Study (institution or country)	**Proposed Indicator with regard to the issue**
METEOR (EU: CIVITAS)	-
NFP (Switzerland)	-
BPI/PRR (UBA Germany)	The indicator is a question, which can be proved by a simple yes/no statement. The question with regard to public-private co-operation is: Exists co-operation between administration and citizens, initiatives?
TERM (EU: European Environment Agency)	-
EST (OECD)	-
CSD (Germany)	- -

Methodology sheet: Indicator Fact Sheet

TELLUS objective evaluation
Indicator Fact Sheet for TELLUS objective "Achievement of political and public awareness for TELLUS"
Indicator: media exposure
Indicator: events organised
Indicator: presentations given

Description of the indicators, relevance

Acceptance of transport and environment policies correlates positively with availability of information and awareness of environmental problems. Public awareness and knowledge of environmental problems is therefore central to the development of appropriate transport policies.[17]
Political and public awareness for TELLUS has two meanings: awareness for the several demonstration measures of the TELLUS project and awareness for the TELLUS objectives on the city level which should be reached by the implementation of the demonstration measures.
Awareness for demonstration measures: The better people are informed about the new measures the more likely they will take advantage of the measures and the better the measure performance will be.
Awareness for TELLUS objectives: Beside awareness for the demonstration measures TELLUS also aims at raising awareness for the necessity of a more environmentally friendly and a more efficient transportation system which takes into account the variety of consequences of the transport sector. These issues are expressed in the TELLUS objectives. Awareness for these issues also raises the acceptance for integrated policy strategies.
The better politicians are aware of such topics the better the chances of implementation of a sustainable transportation policy and planning will be.

Unit of the indicator

Quantitative and qualitative analysis.

Indicator-related objectives

Achievement of awareness.

Methods of measurements

The assessment of the TELLUS objective is done by a media analysis. The following media are analysed:

- - newspapers, transport journals, flyers,
- - events and meetings,
- - TV and radio features,
- - internet.

[17] EEA (2000), p. 123.

The analysis is done according to the following criteria:

- for media exposure: target groups, coverage (spatial, number of people reached), keynote of the article, internal-/external-initiated
- for events organised: local, national, international; internal or public meeting, number of participants.
- for presentations given: context of the presentation/kind of meeting where the presentation is given (local, national, international; internal or public meeting, number of participants), keynote of the presentation, speaker).

The issue of political awareness will be evaluated by looking at the number of presentations for the politicians, and also by considering the integration of the TELLUS demonstration measures into local transport policy.

Source of data and analysis

Data collection and analysis was done by the local measure leaders in close co-operation with the dissemination leader.

Through the work made in the different demonstration measures, TELLUS has had a great impact in publicity and visibility in Göteborg. Many of the measures are widely known in Göteborg and in all official documentation and publicity of the measures, the TELLUS project and logotype has been used, thus improving the awareness for TELLUS in Göteborg. Concerning other publications and publicity not under control by the TELLUS project, TELLUS has not always been mentioned, since focus often is on the measures and the results of the measures. Thus it should be noted, that the major part of the awareness has been achieved on the measures themselves, i.e. the awareness of the different measures is higher than the awareness of TELLUS.

Politicians

Each year, there have been presentations in the Traffic and Public Transport Committee about the TELLUS project and its progress. By the active involvement of deputy mayor Anneli Hulthén in the CIVITAS Policy Advisory Committee, the project has become very well known to the politicians in Göteborg.

Research and Development Centres

In Göteborg there are already developed channels for knowledge transfer with the University of Göteborg and Chalmers University of Technology. Through the involvement of TFK – Institutet för Transportforskning based on Chalmers, the knowledge about TELLUS and its local initiatives has become known at the university. A number of student theses by students at Chalmers University have been written within WP 9.5 and WP 10.5.

Business Community

The co-operation with the business community in Göteborg is important, not only for the dissemination of TELLUS but also for the implementation of the measures and the exploitation of new transport solutions. Göteborg has a long tradition of working close to companies within the environmental sector. After the first amendment, three haulage companies entered TELLUS as partners, which deepened the collaboration further. Within all the measures, focus has been put on developing networks with the business sector. Workshops have been held and seminars and smaller information meetings have been arranged continuously during the project.

Media

TELLUS Göteborg has gained a lot of attention in the media, both on local and on national level. Press releases have been sent out in relation to major events, such as the CIVITAS City of the Year award in November 2004 and the Goods and logistics workshop held in Göteborg in June 2005. The City of the Year award, that Göteborg won, gained very much attention in all kinds of media. All the individual TELLUS measures have also been presented in the local media. Experiences show, however, that it is much easier to get attention for the local measures as such than for the concept of the EU-project TELLUS.

Residents of Göteborg

One of the projects in Göteborg was meant to have more advertising and activities directed to the inhabitants than the other projects. This was the Environmentally Optimised ferry shuttle (WP 7.6). The other measures should also be marketed but more indirectly for the residents. Since WP 7.6 unfortunately was cancelled, the direct information campaigns towards the public did not take place. However, the attention for the other measures, in the media for example, has made them more visible for the public than was expected.

Time table to obtain and analyse the data

The collection of the relevant data was done continuously, and was analysed yearly.

Relation to other indicator systems

Study (institution or country)	**Proposed Indicator with regard to the issue**
METEOR (EU: CIVITAS)	Awareness level: knowledge of the new integrated measures on account of provided information. Data collection could be done by means of surveys (questionnaires or face to face interviews).
NFP (Switzerland)	-
BPI/PRR (UBA Germany)	-
TERM (EU: European Environment Agency)	Public awareness and attitude towards the environmental threats brought about by the transport sector.
EST (OECD)	-
CSD (Germany)	-

Annex 1
Location of measurement points.