Indicator Fact Sheets

ROTTERDAM

Indicator Fact Sheets

List of indicators

TELLUS objective	Indicator	Unit of the indicator
Reduce congestion	mean journey times between given locations	Minutes per journey
	average speed between given locations	Km/hr (derived)
reduce NOx emissions	NOx emissions	Tons p.a.
Reduce air pollution	level of CO	milligramme/m³
	level of NO_2	µg/m³
	level of PM_{10}	
	level of benzene	
reduce traffic related CO_2 emissions	CO_2 emissions	Tons p.a.
reduce noise	Noise level	dB(A) number of inhabitants
reduce traffic related energy use	Primary energy use	TeraJ/a
	Final energy use	TeraJ/a
	Type-specific final energy use	TeraJ/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 kilo-metres)
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	

Methodology sheet: Indicator Fact Sheet

TELLUS objective evaluation
Indicator Fact Sheet for TELLUS objective "reduce congestion"
TELLUS Key Indicator: mean journey time on selecter routes within area
(trip-related congestion measures)
Derived indicator: average speed on selected routes within an area

Context, Description of the indicator

The indicator „mean journey times" is appropriate to measure the phenomenon congestion. The longer the mean journey time between given locations is, the lower is the flow of traffic and the average speed. The unit of observation are the roads within an area. 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 mean journey time between given locations yields the average speed on the selected routes within an area.

Unit of the indicators

Average speed (km/h) on city roads within an area in evening peak.

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 will make travel 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

Each year, in April and May, several people with stopwatches are driving selected routes. The mean journey times (in seconds per route) is a direct indicator. In addition the indicator allows the calculation of the average speed within an area as an indirect indicator.
For 2010 the average speed is an expert judgement. Because there are no valuable model simulations.

Source of data and analysis

The data is generated and provided by the city of Rotterdam / dS+V.

Time table to collect and analyse the data

Retrospective view: from 1998 until the end of the TELLUS project, the data will be collected and analysed yearly.

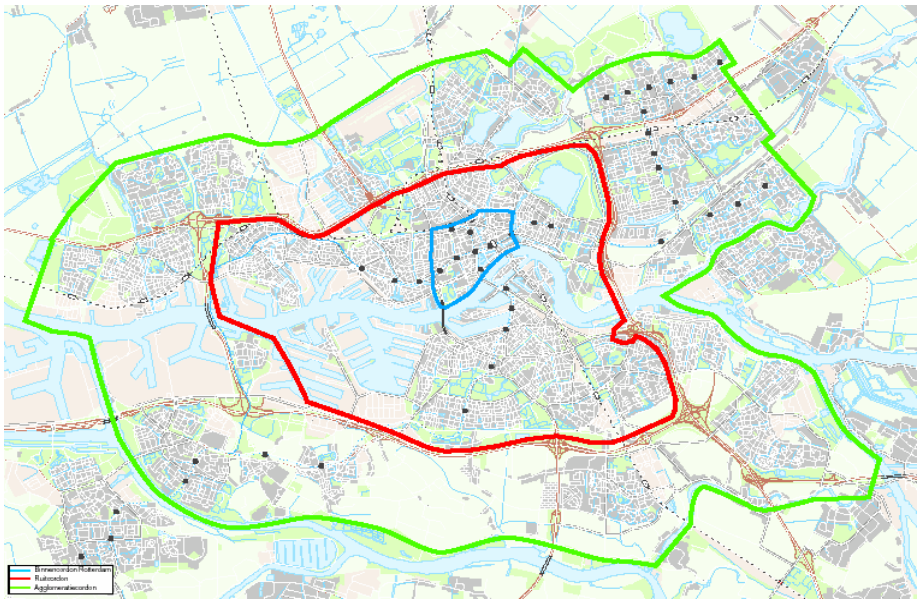
Development of the indicator value

Average speed (km/h) on city roads in evening peak

	1998	1999	2000	2001	2002	2003	2004	*2010 **
Center and surrounding area (blue and red area – figure below)	27	24	22	21	23	22	21	*20*
Periphery (area between red and green – figure below)	38	36	30	32	32	32	32	*30*
Total	30	28	25	24	26	25	24	*22*

Source: city of Rotterdam / dS+V

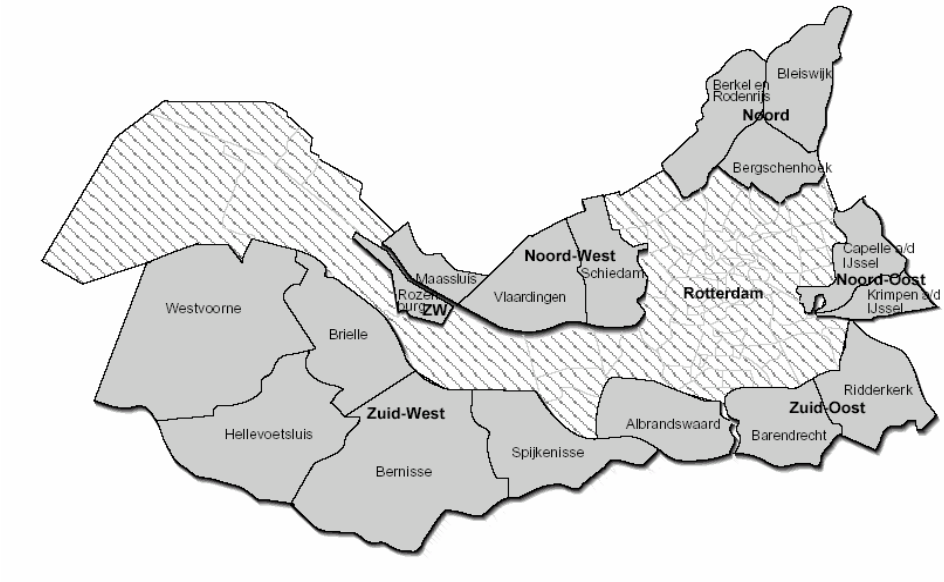
*The average speed in 2010 is an expert judgement. There are no valuable model simulations for 2010.



Source: city of Rotterdam / dS+V

Since 1998 the average speed on the city roads has decreased indicating a growing congestion problem. The decrease is caused by a risen car possession and subsequently a larger number of cars on the roads. Since 2000 the average speed seems to be stabilized and experts think that the average speed will be stable for the coming years.

The region Rotterdam (the city Rotterdam and 17 municipalities)



Relation to other indicator systems

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Methodology sheet: Indicator Fact Sheet

TELLUS objective evaluation
Indicator Fact Sheet for TELLUS objective "reduce traffic related 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 per cent of NOx emissions.[1]

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.[2] 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.[3]

Unit of the indicator

Tons per year.

Indicator-related objectives

None.

Methods of measurement

Model calculation (emission module of the model "Promil"), the calculation is a combination of traffic-specific (e.g. number of vehicles, driving mode) and vehicle-specific emission-factors.

Source of data and analysis

The environment department of region Rotterdam works out regularly an emission inventory for the transport sector.

Legal basis, standard values, political objectives

On a national level ambitions for NOx-emissions are laid down in the fourth Environmental Policy Plan (NMP4). NOx has an impact on both the themes of acidification and smog formation. An emission reduction of 80-90% is proposed to be reached in 2030 in comparison with the emission level of 1990.

[1] OECD 1999, p. 13.
[2] 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."
[3] OECD 1999, p. 21

Time table to collect and analyse the data

Retrospective view: from 1998 until the end of the TELLUS project, the data will be collected and analysed yearly.

Development of the indicator value

Tons NO_X p.a. by traffic in the region Rotterdam

	1998	1999	2000	2001	2002
Nitrogen oxides (NO_X)	9.972	11.357	10.771	11.218	10.475

Source: city of Rotterdam, DCMR

The emission of NO_X by traffic are stable, despite of the risen number of vehicle kilometres.
The stable tons p.a. by traffic is the result of cleaner vehicles.

Relation to other indicator systems

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Methodology sheet: Indicator Fact Sheet

TELLUS objective evaluation
Indicator Fact Sheet for TELLUS objective "reduce traffic related CO_2 emissions"
Indicator: CO_2 emissions

Context and impacts

Directly and indirectly, fossil fuels provide the energy for almost all transport activities. Transport is the fastest growing energy consumer in the EU.[4] Carbon dioxide emissions (CO_2) are also a surrogate for the use of fossil fuels. CO_2 emissions from transport in the EU increased by 15% between 1990 and 1998. Road transport is the main cause of this increase and contribute 84% of CO_2 emissions from the transport in 1998[5].
The global impact of fossil fuel use is that the atmospheric concentrations of the greenhouse gases carbon dioxide, methane (CH_4) and nitrous oxide (N_2O) have grown significantly. Carbon dioxide is the transport emission of greatest concern in respect of global impacts on account of its likely involvement in climate change. In the EU CO_2 contributing about 80% of the total EU greenhouse gas emissions. 24% of the carbon dioxide emissions result from the combustion in fossil fuels in the transport sector.[6]

Unit of the indicator

Tons per year.

Indicator-related objectives

Reduce traffic related CO_2 emissions by 5% until 2006
Reduce traffic related CO_2 emissions by 10% until 2010

Methods of measurement

Model calculation for the region (emission module of the model "Promil"). The calculation is a combination of traffic-specific (e.g. number of vehicles, driving mode) and vehicle-specific emission-factors.

Source of data and analysis

The environment department of region Rotterdam regularly performs an emission inventory for the transport sector.

Legal basis, standard values, political objectives

On a national level ambitions for NOx-emissions are laid down in the fourth Environmental Policy Plan (NMP4). Based on the Kyoto treaty an emission reduction of 6% is envisaged compared to the base-year 1990.

Time table to collect and analyse the data

[4] EEA (2001), p. 14.
[5] EEA (2001), p. 14.
[6] METEOR (2002).

Retrospective view: From 1998 until the end of the TELLUS project, the data will be collected and analysed yearly.

Development of the indicator value

Tons p.a. by traffic in the region Rotterdam

	1998	1999	2000	2001	2002
Carbondioxide (CO_2)	1.565	1.756	1.825	1.806	1.798

Source: city of Rotterdam, DCMR

The emission of CO_2 by traffic are stable, despite of the risen number of vehicle kilometres.
The stable tons p.a. by traffic is the result of cleaner vehicles.

Relation to other indicator systems

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Methodology sheet: Indicator Fact Sheet

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

Not available.

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).[7]

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.[8]

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 EC directives until 2006.

Methods of measurement

Air quality is one of the major elements of environmental analysis in urban transport. Rotterdam keeps an air quality monitoring network. Changes in the concentration of NO_2 over the lifetime of the TELLUS Project can be observed and comparisons to the time before the implementation of TELLUS can be made. Nevertheless, the interpretation of the indicator has to take into consideration that the local air quality is influenced by a variety of non-transport and non-project related factors.
Rotterdam uses also air pollution models to calculate concentrations of air pollutants (model: Urbis).

Source of data and analysis

The environment department of the region Rotterdam.

TNO (Urbis model graphics)

Legal basis, standard values, political objectives

EU directive: Council Directive 1999/30/EC. Implemented in national directive: Besluit Luchtkwaliteit (2001).

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

	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

Time table to collect and analyse the data

Retrospective view: From 1998 until end of the TELLUS project, the data will be collected and analysed yearly.

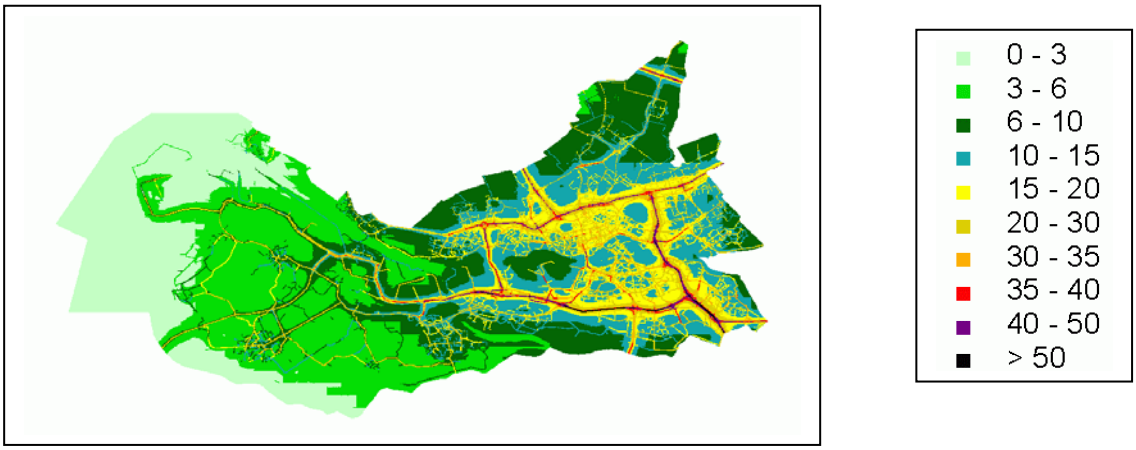
Development of the indicator value

Level of NO_2 (equal annual in µg/m³)

	1998	1999	2000	2001	2002	2003	2004
NO_2	41	40	39	39,7	40,4	41,6	37,5

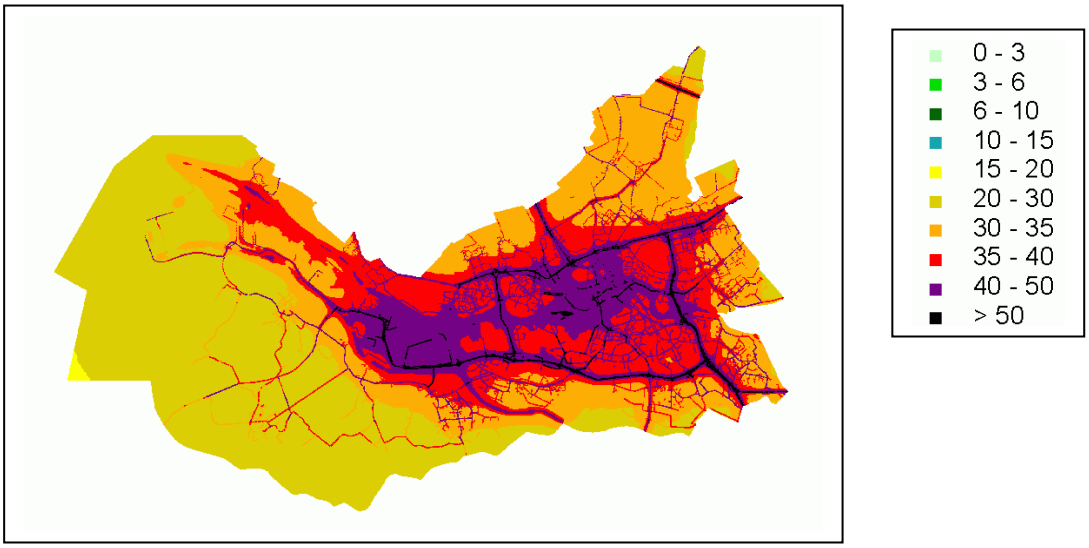
Source: city of Rotterdam, DCMR

NO_2 level - traffic related (in µg/m³), based on data from 2000 (TNO - Urbis model)



Source: TNO - Urbis model

NO_2 level - total (in µg/m³) based on data from 2000



Source: TNO - Urbis model

The maps gives an overview of the NO_2 level in the region. The level of 40 µg/m³ is exceeded in several areas in the region: the harbour, around the main roads and parts of the city Rotterdam.
The annual limit value is since several years around the 40 µg/m³. The hourly limit of 200 µg/m³ is in the last years hardly occurred.

Relation to other indicator systems

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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.[9]

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 EC directives until 2006.

Critical aspects

EC directives are not sufficient to prevent serious health risks.

Methods of measurement

Use of the data of the air quality monitoring network in the region Rotterdam (6 measure points, see table).

Air quality is one of the major elements of environmental analysis in urban transport. Rotterdam keeps an air quality monitoring network. Changes in the concentration of PM_{10} over the lifetime of the TELLUS Project can be observed and comparisons to the time before the implementation of TELLUS can be made. Nevertheless, the interpretation of the indicator has to take into consideration that the local air quality is influenced by a variety of non-transport and non-project related factors.

Rotterdam uses also air pollution models to calculate concentrations of air pollutants (model: Urbis).

Source of data and analysis

The environment department of the region Rotterdam.

TNO (Urbis model graphics)

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

Legal basis, standard values, political objectives

EU directive: Council Directive 1999/30/EC. Implemented in national directive: Besluit Luchtkwaliteit (2001).

	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.

Time table to collect and analyse the data

Retrospective view: From 1998 until end of the TELLUS project, the data will be collected and analysed yearly.

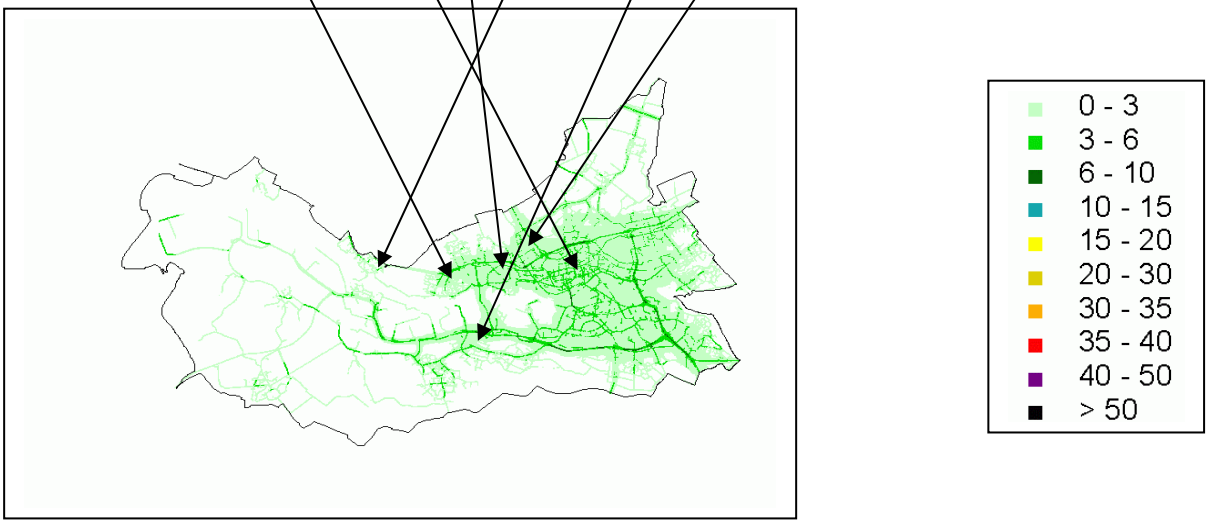
Development of the indicator value

Level of PM_{10} on several locations (see map below)

	Vlaardingen (RIVM)	Rotterdam (RIVM)	Schiedam (DCMR)	Maassluis (DCMR)	Hoogvliet (DCMR)	Overschie (DCMR)
	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3
1998	39,5	41,7				
1999	35,1	37,2				
2000	31,9	35,8				
2001	32,2	37,2	42,9			
2002	32,2	39,2	44,5			46,0
2003	36,7	43,0	45,8	41,9	45,2	47,3
2004	30,0	37,0	32,2	27,6	29,5	32,5
	Vlaardingen	Rotterdam	Schiedam	Maassluis	Hoogvliet	Overschie

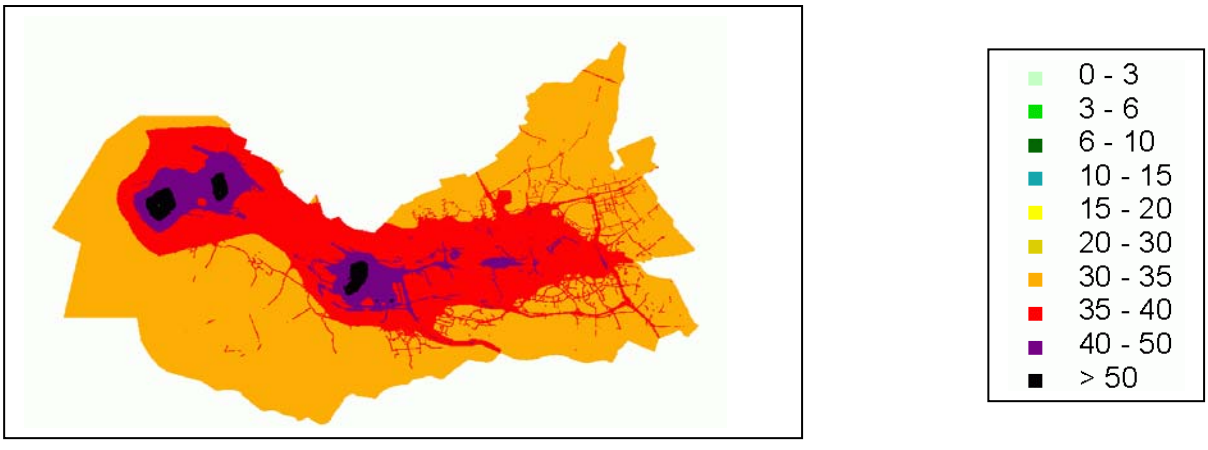
Source: city of Rotterdam, DCMR

PM_{10} traffic related (in µg/m³), based on data from 2000 (TNO - Urbis model)



Source: TNO, Urbis model

PM_{10} total (in µg/m³), based on data from 2000 (TNO - Urbis model)



Source: TNO, Urbis model

The maps gives an overview of the PM_{10} level in the region. The level of 40 µg/m³ is exceeded mainly in the harbour and around de river. But also around the main roads.

References

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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.[10]

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 neurotoxity, 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 EC directives until 2006.

Critical aspects

EC directives are not sufficient to prevent serious health risks.

Methods of measurement

Use of the data of the air quality monitoring network in the region Rotterdam (4 measure points, see table).

Air quality is one of the major elements of environmental analysis in urban transport. Rotterdam keeps an air quality monitoring network. Changes in the concentration of benzene over the lifetime of the TELLUS Project can be observed and comparisons to the time before the implementation of TELLUS can be made. Nevertheless, the interpretation of the indicator has to take into consideration that the local air quality is influenced by a variety of non-transport and non-project related factors.

Source of data and analysis

The environment department of the region Rotterdam.

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

Legal basis, standard values, political objectives

EU directive:

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

Time table to collect and analyse the data

Retrospective view: From 1993 until end of the TELLUS project, the data will be collected and analysed yearly.

Development of the indicator value

Level of Benzene on several locations (see map p.15)

	Schiedam	Hoogvliet	Maassluis	Overschie
	µg/m^3	µg/m^3	µg/m^3	µg/m^3
1998	3,8	3,0	2,7	
1999	3,2	2,7	2,8	
2000	2,6	2,2	2,4	
2001	2,6	2,3	2,1	
2002	2,5	2,1	2,3	1,5
2003	2,2	2,1	2,3	1,8
2004	1,4	2	2,1	1,6

Source: city of Rotterdam, DCMR

The annual limit value on the four measure points are in the last years never occurred.

References

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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).[11]
Traffic noise is the most important source of environmental annoyance. 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 longterm environmental noise exposure.

Unit of the indicator

Number of inhabitants with a noise level >45 dB(A) in the region of Rotterdam.

Indicator-related objectives

Reduce number of inhabitants with a noise level >65 dB(A).

Critical aspects

Methods of measurement

An analysis by the environmental department of the region Rotterdam.

Source of data and analysis

The environment department of the region Rotterdam analyses the noise levels at roads, rails and industry.

Legal basis, standard values

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Time table to collect and analyse the data

2002 and 2010.

[11] EEA (2000), p. 32.

Development of the indicator value

Number of inhabitants with noise level >45dB(A) in the region of Rotterdam in 2002

	45 - 50 dB(A)	50 - 55 dB(A)	55 - 60 dB(A)	60 - 65 dB(A)	> 65 dB(A)
roads	16.000	125.000	390.000	444.000	189.000
rail	146.000	71.000	27.000	6.000	1.000

Difference in number of inhabitants with noise level >45dB(A) in the region of Rotterdam between 2002 - 2010

	45 - 50 dB(A)	50 - 55 dB(A)	55 - 60 dB(A)	60 - 65 dB(A)	> 65 dB(A)
roads	+6.000	+10.000	-14.000	+12.000	+27.000
rail	+56.000	+47.000	+19.000	+6.000	+2.000

Source: DCMR

Between 2002 and 2010 the number of residents that will be exposed to noise from road traffic, rail traffic and industry will rise. The increases are caused by: a general increase of road traffic and rail traffic. But also the increasing number of residents themselves plays an important role here making it inevitable that in a densely populated area conflicts between functions will occur.

References

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Methodology sheet: Indicator Fact Sheet

TELLUS objective evaluation
Indicator Fact Sheet for TELLUS objective "reduce traffic related energy use"
Indicator: Primary energy use
Indicator: Final energy use
Indicator: Type-specific final energy use

Context, impacts

Transport is one of the main energy consuming sectors in the EU (over 30 % of total final energy consumption in 1997). Its energy use is growing at about 3 % per annum. Road transport is responsible for 73 % of transport energy consumption.
Transport is nearly fully dependent on fossil fuels (99 %), and contributes significantly to emissions of greenhouse gases, acidifying substances, ozone precursors and other air pollutants.[12] Transport contribute 24% of the total CO_2 emissions in the EU.
Growth in road transport is the main cause of the increase in energy use: the increasing use of heavier more powerful cars and trucks along with low occupancy rates and load factors have offset improvements in fuel economy – mostly related to engine technology.[13]

Unit of the indicator

TeraJ/a

Indicator-related objectives

Reduce traffic related energy use by 5% until 2006.
Reduce traffic related energy use by 10% until 2010.

Critical aspects

Methods of measurement

Generic data of final energy use per transport mode is combined with specific data on transport movement in the Rotterdam area.

Source of data and analysis

Generic energy data is derived from Dutch Statistics (CBS). Specific Rotterdam data is collected by the Municipality of Rotterdam (DS+V). The indicator related analysis is by dS+V.

Legal basis

[12] EEA (2000), p. 18.
[13] EEA (2000), p. 19.

Time table to obtain and analyse the data

Retrospective view: since 2002 until end of the TELLUS project, the data will be obtained yearly.

Development of the indicator value

Relation to other indicator systems

References

Methodology sheet: Indicator Fact Sheet

TELLUS objective evaluation
Indicator Fact Sheet for TELLUS objective "reduction of road casualties and injured persons"
Indicator: fatalities, road accident-related injuries

Context, impacts

Road accidents are responsible for a large number of injuries and fatalities. In the EU road accidents claimed a total of 41 000 lives in 1998, but numbers have fallen by 28 % since 1980. Road accidents are the largest cause of death for persons under 40.[14]

During recent decades, a considerable effort has been made to reduce the number and severity of transport accidents, including educational programmes, limitation of permitted blood alcohol level in drivers, speed limits, technical measures such as safety belts and air bags, as well as traffic control measures.

Transport safety is a part of the social dimension of sustainability. The chance to get involved in a traffic accident provides a direct contribution to measuring the quality of life. Due to this high risk many people, especially the elderly and children, feel insecure and are constricted in their mobility.

Accident rates are known to vary with the quality of road infrastructure, the technology of vehicles, the behaviour of drivers, traffic regulations, vehicle density etc. While policies must address each and every such aspect, this indicator provides an aggregated measure of the overall policy performance with regard to safety.[15]

Unit of the indicator

Total number of fatalities and road accident-related injuries (in region Rotterdam).

Indicator-related objectives

None.

Methods of measurement

Data from ongoing statistics and 2010 by analyses of the SWOV.

Source of data and analysis

SWOV, Ministry of transport (RWS/AVV) and dS+V/Gemeente Rotterdam collect and analyse the data.

Time table to collect and analyse the data

Retrospective view: From 1997-99 until the end of the TELLUS project, the data will be collected and analysed yearly. The prognoses are made by the SWOV.

[14] EEA (2001), p 21.
[15] See METEOR (2002), Annexes

Development of the indicator value

Number of killed and injured persons in traffic in the region of Rotterdam

	1998	2000	2001	2002	2003		2010
Fatalities (killed persons)	47	47	40	55	44		29
Injured persons within admission to hospital	561	570	459	429	401		319
Injured persons without admission to hospital	2995	2.687	2.206	2.144	1.938		?

Source: AVV and SWOV

The number of injured persons in traffic decreased over the last years. The number of people killed in traffic strongly fluctuates over the years, but also there a decreasing trend is visible. These trends are expected to continue till 2010.

References

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Methodology sheet: Indicator Fact Sheet

TELLUS objective evaluation
Indicator Fact Sheet for TELLUS obj. "Increase the modal share in favour of public transport"
Indicator: Average modal split

Context, impacts

Total passenger kilometres travelled in the EU have more than doubled over the period 1970-1997. The average growth rate of 2.8 % per year is even higher than the average growth in GDP over the same period (2.5 % per year).[16]

Passenger car transport is the mode most used in the EU: over the period from 1980 to 1997 its share rose from 66 to 77 %.

Shares of rail are decreasing, as the train is often not considered to be an attractive option despite increasing congestion on roads, partly because of inefficient rail services.

The modal shares of walking and cycling have fallen. Yet half of all car trips are less than 6 km, for which cycling is often faster than driving (in urban areas); 10 % are less than 1 km, an ideal walking distance.[17]

Motorised vehicles are a burden on the environment in terms of emissions, noise, congestion. Further more the amount of space in the cities for alternative usage decreases. The performance of measures should be monitored through the dynamics of modal split. The modal split of non motorised modes should increase in the context of successful demonstration measures.

Unit of the indicator

Percentage of trips (number) and travelled distance (km) by inhabitants of city Rotterdam.

Indicator-related objectives

Increase the modal share in favour of public transport by about 3% until 2006.
Increase the modal share in favour of public transport by about 5% until 2010.

Critical aspects

The modal split is a controversy indicator since it is the percentage of a variable main unit. Consequently the percentage of car trips can decrease (recognized as a positive trend) while the absolute number of trips by car increase continuously because the main unit increases too.

Methods of measurement

Question lists and modelling.

Source of data and analysis

Dutch Statistics (CBS). Derived from CBS-survey on mobility behavior and the RVMK.

[16] EEA (2000), p. 48.
[17] EEA (2001), p. 23.

Time table to collect and analyse the data

Retrospective view: From 1997 until the end of the TELLUS project. The data will be collected as often as results are available.
2010 is modelled by the RVMK. To keep the figures similar with the RVMK (2010), the category 'others' has been omitted.

Development of the indicator value

Number of trips per day by inhabitants of region Rotterdam (trips both in and outside the boundaries of the city)

	cars	train	bus/tram/metro	moped	bike	total
1997/1998	1,35	0,07	0,07	0,03	0,60	2,11
1998/1999	1,36	0,06	0,06	0,03	0,57	2,09
1999/2000	1,31	0,06	0,06	0,03	0,54	2,01
2000/2001	1,30	0,07	0,07	0,03	0,53	1,99
2001/2002	1,31	0,06	0,06	0,02	0,51	1,95
2010	1,62	0,08	0,08	0,03	0,62	2,44

%	cars	train	bus/tram/metro	moped	bike	total
1997/1998	64%	3%	3%	1%	28%	100%
1998/1999	65%	3%	3%	2%	27%	100%
1999/2000	65%	3%	3%	2%	27%	100%
2000/2001	65%	3%	3%	1%	26%	100%
2001/2002	67%	3%	3%	1%	26%	100%
2010	66%	3%	3%	1%	25%	100%

Source: CBS, Statline / RVMK

Number of travelled kilometers per day by inhabitants of region Rotterdam (kilometers made both in and outside the boundaries of the city)
2010 is unknown.

	cars	train	bus/tram/metro	moped	bike	total
1997/1998	22,1	2,4	2,7	0,2	2,0	29,4
1998/1999	21,9	2,4	2,9	0,2	1,9	29,2
1999/2000	21,2	2,5	2,9	0,2	1,7	28,5
2000/2001	20,8	2,6	2,7	0,2	1,7	28,0
2001/2002	21,2	2,3	2,6	0,1	1,6	27,8

%	cars	train	bus/tram/metro	moped	bike	total
1997/1998	75%	8%	9%	1%	7%	100%
1998/1999	75%	8%	10%	1%	6%	100%
1999/2000	74%	9%	10%	1%	6%	100%
2000/2001	74%	9%	10%	1%	6%	100%
2001/2002	76%	8%	9%	0%	6%	100%

Source: CBS, Statline

The number of trips will increase up to 2010. Particularly the number of trips with the car and the bicycle will increase.

Methodology sheet: Indicator Fact Sheet

TELLUS objective evaluation
Indicator Fact Sheet for TELLUS objective "Reduce car kilometres"
Indicator: Car kilometres

Context, impacts

Passenger transport demand especially by car has increased much more rapidly than population over the past 25 years, reflecting a rise in mobility: the average daily distance travelled by EU citizens was 16.5 km in 1970 and 36 km in 1996. The spatial spread of economic activities, urban sprawl, the evolving services sector, higher disposable income and car ownership, and increased leisure time all influence mobility.[18]

In the EU the car fleet has increased by 64 % since 1980, to 451 per 1 000 inhabitants (1998).[19]

Car kilometres are an important input variable for ecological and social adverse effects in the transport sector. The higher vehicle kilometres are, the higher are emissions, noise levels, consumption of resources and the annoyance of the inhabitants.

Unit of the indicator

Car kilometres per year.

Indicator-related objectives

Reduce car kilometres by 3% until 2006
Reduce car kilometres by 5% until 2010

Methods measurement

Estimations on the basis of traffic trends. 2010 modelled by the RVMK.

Source of data and analysis

DS+V / Gemeente Rotterdam.

Time table to obtain and analyse the data

Retrospective view from 1998 until the end of the TELLUS project. The data will be collected as often as results are available.

[18] EEA (2000), p. 45 et seq.
[19] EEA (2001), p. 23.

Development of the indicator value

Number of car kilometres (*1.000.000) in the region of Rotterdam per year

	1998	1999	2000	2001	2002	2003
Car kilometres	6.256	6.404	6.194	6.293	6.258	6.292

Source: city of Rotterdam, dS+V

Between 1998 and 2010 the number of car kilometers will increase with 30% (source: RVMK).

The amount of car kilometres has risen also since 1998 in the region of Rotterdam and is expected to rise further to 2010.

References

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Methodology sheet: Indicator Fact Sheet

TELLUS objective evaluation
Indicator Fact Sheet for TELLUS objective "Increase of public transport use"
Indicator: Passenger kilometres
Indicator: Passengers

Description of the indicators, relevance

Growing attractiveness of public transport should be mirrored in increasing numbers of passenger kilometres and passengers.
Alternatives to the car are often lacking or less attractive, or ill adapted to new urban patterns. Initiatives like improved services are emerging to counter this trend but these have as yet had little impact.[20]

Unit of the indicator

Passenger kilometres, Passengers (total number)

Indicator-related objectives

Increase of public transport use by 5% until 2006.
Increase of public transport use by 10% until 2010.

Critical aspects
Increasing numbers of passenger kilometres and passengers are not necessarily combined with decreasing numbers in car kilometres and are consequently not appropriate to show a trend towards more sustainability.

Methods of measurement

Modelled by the RVMK and assessments by the local public transport company.

Source of data and analysis

The RVMK and local public transport companies RET (trams, metro) and Connexxion (bus).

Time table to obtain and analyse the data

Retrospective view from 1998 until the end of the TELLUS project. The data will be collected as often as results are available.

[20] EEA (2001), p. 23.

Development of the indicator value

Passenger kilometres (*1.000.000) by bus, tram and metro in the region Rotterdam (excl. train)

	1998	1999	2000	2001	2002	2003
Passenger kilometres	874	881	908	910	899	904

Source: city of Rotterdam

Between 1998 and 2010 the number of passengers kilometers will increase with 30% (excl. train) (source: RVMK)

The number of passenger km by bus, tram and metro will increase till 2010. The number of passenger km by train will decrease because the costs of the care are decreasing and the costs of the train will increase till 2010.

References

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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

The MAESTRO approach addresses no particular indicators for the Intra Organisational Cooperation. The importance hawever is without doubt since the European Union explicitly is striving fo improved cooperation as a tool for integration and implementation of sustainable mobility.

Unit of the indicator

Percentage of Intra Organisational Cooperations that have improved.

Indicator-related objectives

Qualitative terms

Methods of measurement

During the TELLUS forum of January 20th 2004 a questionnaire was handed out to all WP leaders and project leaders present. Two weeks later a remainder was send by E-mail.
17 out of 27, i.e. 63%, filled in the questionnaire.

Key question was if, in the respondents opinion, the Intra Organisational Cooperation (IOC) has improved due to TELLUS. More cooperation because of TELLUS activities such as the TELLUS project meetings is obvious. That is why we explained to the WP leaders and project leaders that an improved IOC is defined as a stronger IOC outside the TELLUS project itself.

Three out of 17 respondents judged the question as 'irrelevant' as they already have a high quality IOC. Therefore the analysis was carried out for 14 respondents divided over 7 organisations.

Each respondent could indicate whether the IOC with 6 other organizations has improved due to TELLUS. As a result the maximum score for improved IOC is 14 x 6 = 84 points.

Analysis shows that the score on this indicator is 29. I.e. the IOC has improved by 35%

Source of data and analysis

Questionnaire made and analysed by the Rotterdam LEM (IVAM).

Time table to obtain and analyse the data

Development of the indicator value

The improved IOC is mainly caused by the TELLUS forum (64%)[1] and by the demonstration project itself (55%). The international meetings contribute for 23% to the improved IOC.
This relatively low contribution is explained by the fact that the project leaders visit all Forums but only occasionally visit a European meeting.

According to 64% of the respondents the improved IOC has also improved the quality of the cooperation and 82% think that the improved IOC will probably be lasting after the TELLUS project. Most of the respondents that find the quality of IOC not improved think it is too early to draw this conclusion.

This survey on IOC will be repeated in 2005. The results of the 2005 survey will be compared to the present survey.

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

The MAESTRO approach addresses no particular indicators for the Intra Organisational Cooperation. The importance however is without doubt since the European Union explicitly is striving fo improved cooperation as a tool for integration and implementation of sustainable mobility.

Unit of the indicator

Percentage of respondents that mention an improved Public Private Cooperation.

Indicator-related objectives

Qualitative terms

Methods of measurement

During the TELLUS forum of January 20th 2004 a questionnaire was handed out to all WP leaders and project leaders present. Two weeks later a remainder was send by E-mail.
17 out of 27, i.e. 63%, filled in the questionnaire.

The questionnaire was used to measure the Intra Organisational Cooperation. In preparation of a number of interviews about the Public Private Cooperation in 2005, one question was added to the present survey

Source of data and analysis

Questionnaire made and analysed by the Rotterdam LEM (IVAM).

Time table to obtain and analyse the data

Development of the indicator value

4 out of 17 respondents, *i.e.* 24%, mentioned an improved PPC.

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

The awareness both public and political is considered very relevant by the European Union to increase acceptance for EU funded projects in general and integration and implementation of sustainable mobility in particular.

Unit of the indicator

The media exposure is defined as all dissemination activities by demonstrator contacts about TELLUS without addressing the particular target group of a measure. The following definitions for dissemination routes have been used:

Media
Articles (papers, magazines, Web-sites, etc.)
Information Brochures

Event (i.e. event organized by demonstrator)
Workshop
Seminar
Conference
Congress
Official opening
Visit by foreign company, authorities, etc
Publicity campaign
Brochure & information stand at conference
Implementation of information banner

Presentation (i.e. presentation other that at own 'event')
Presentation

Indicator-related objectives

Qualitative terms

Methods of measurement

Countings.

Source of data and analysis

TELLUS progress and management reports analysed by the Rotterdam LEM (IVAM).

Time table to obtain and analyse the data

2001 - 2005.

Development of the indicator value

Table Overview of activities during the period 1-2-2001 – 1-2-2005

	Measure	Media	Events	Presentations
5.1	Access time window		4	
5.2	Dedicated bicycle routes			
5.3	Truck parking management			2
5.4	Transport priority and dedicated lanes		2	
6.1	P&R pricing strategies for target groups	3	1	
6.2	Kilometer pricing	3	1	
6.3	Demand dependent paid parking		1	2
7.1	Integration of cycling and public transport			
7.2	Large scale expansion of P&R			
7.3	PT over water		3	
7.4	Automated people movers	2	1	2
8.1	Electric two-wheelers	4	3	8
8.2	Expansion of van pooling for commuters		4	2
8.3	Expansion of car sharing		3	
9.1	E-commerce logistics		1	
9.2	Multi core tube logistics		1	2
10.1	Green commuter plans	1	2	1
10.2	Integration of P-P transport Initiatives.		5	
10.3	New approaches to integrated planning		4	
11.1	Integration of transport management systems		3	
11.2	Intermodal travel information			
11.3	Dynamic PT information			
12.1	Clean and silent PT fleet			4
12.2	Electric vehicles for the distribution of goods			5
12.3	Cleaner vehicles for waste collection			1
12.4	Electric vehicles in public fleets			1
	Total number:	13	39	30

References

Fourth National Environmental Policy Plan (NMP4) , 2001, VROM
Organistion for Economic Co-operation and Development (OECD), 1991
EU directive: Council Directive 1999/30/EC. Implemented in national directive: Besluit Luchtkwaliteit (2001).
Municipality of Rotterdam, dS+V; owner of the RVMK model
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AVV (Institue for transport & traffic research – www.avv.nl)
SWOV (Institute for road safety research – www.swov.nl)
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