Technical report No 18

Towards a transport and environment reporting mechanism (TERM) for the EU

Part 2: Some preliminary indicator sheets

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Annex 2: Some preliminary indicator sheets

Contents

Introduction

This second part of the report gives some concrete examples of how the European Environment Agency and Eurostat envisage to put into practice the TERM methodology that was outlined in *Part 1: TERM concept and process*. A number of TERM indicator sheets are presented, which outline the methodological issues and requirements for future work, and which also include a very **preliminary** analysis of some indicator trends (based on current data availability).

The indicator sheets on energy consumption, accidents, transport demand, vehicle fleet characteristics, fuel and transport prices, and uptake of cleaner fuels, were compiled based on data provided by Eurostat. The Agency (supported by its European Topic Centres) provided the data for the indicator sheets on noise, fragmentation, land take, air quality, emissions and recovery rates. The latter indicator sheets were compiled mainly using material for the forthcoming EEA report *Environment in the EU at the turn of the century* and for the EEA's contribution to the Global Assessment of the 5EAP.[1]

The examples show that the compilation of certain indicators is already feasible, i.e. the current statistical data availability is already sufficient to make a compilation at EU level or for certain countries (e.g. energy consumption, transport volume, emissions).

Other indicators, e.g. those related to noise and biodiversity impacts (fragmentation) will need to be developed in the longer term. These are all themes which have an important policy relevance, but for which multi-year actions have to be undertaken to set up and/or improve data delivery, to develop methods or to conduct more in-depth research. For these indicators, the preliminary indicator sheets mainly outline the existing data and methodological problems and provide suggestions for future work.

Comments on these TERM indicator sheets are welcome.

[1] EEA (1999), Monitoring progress towards integration , a contribution to the Global Assessment of the Fifth EAP, Interim report, (30 March 1999)

Indicator 1: Transport share of total final energy consumption

1. Purpose and policy relevance

This indicator describes the evolution of the energy consumption of transport and compares it to that of the economy as a whole. In Member States energy consumption of transport usually has grown faster than energy consumption of any other sector during the last years. The indicator helps to describe this development.

Energy use induces a broad range of environmental impacts, at each operating phase of the energy system (i.e. production, transmission, transformation, distribution and consumption). The transport sector is highly dependant on fossil fuels, the use of which generates emissions to the air (mainly greenhouse gases and acid compounds). Of particular relevance are the Commission's strategy documents on acidification and tropospheric ozone, and the Community's Climate Change Strategy. The general EU policy on energy and environment is essentially contained in a Communication on the energy dimension of Climate Change (COM(97)196).

There is wide-spread consensus that any strategy aimed at lessening the environmental impact caused by developing energy systems should basically rely on improved energy efficiency and the development of environmental-friendly energy sources (e.g. renewables).

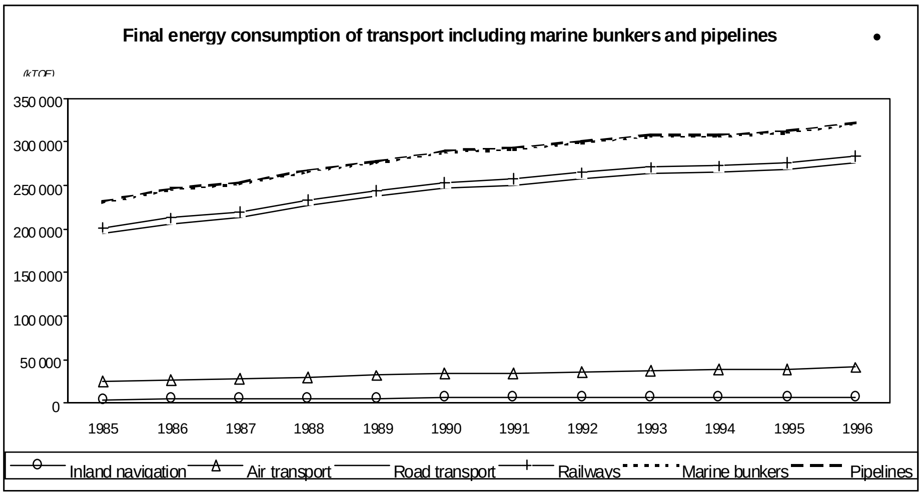
2. Targets

Although there are no specific targets for fuel consumption, the Framework Convention on Climate Change and the Kyoto Protocol to that Convention require a stabilisation of greenhouse-gas emissions at 1990 level by 2000, and a reduction to 92% of 1990 levels by 2010 for the EU as a whole. The major greenhouse gas, carbon dioxide, is directly related to fossil fuel combustion.

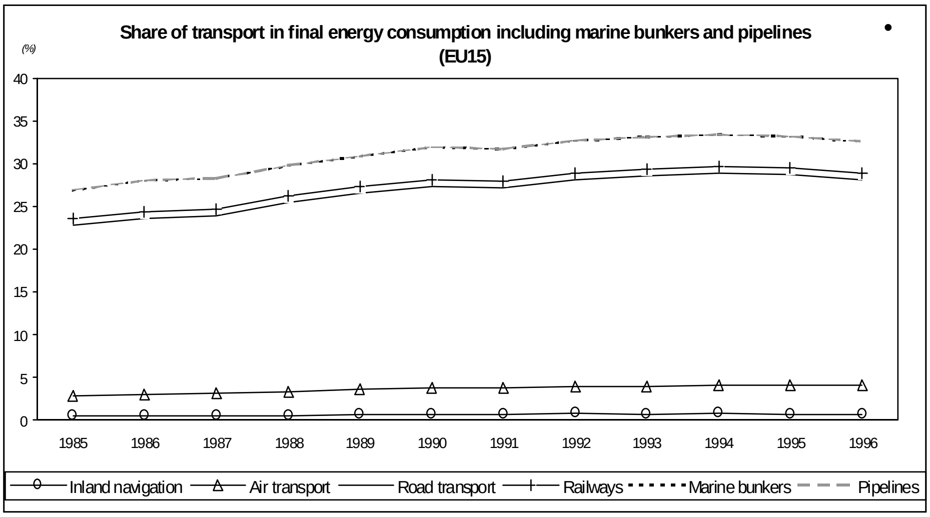
The present target set by the Energy Efficiency Strategy is to cut back on energy intensity by 20% from 1995 to 2010.

The Commission Communication on the future perspectives of the CTP (for the period 2000-2004) states that *'the Commission will give particular attention to measures designed to reduce the dependence of economic growth on increases in transport activity and any such increases on energy consumption,…'*.

3. Preliminary compilation of the indicator



Source: Eurostat



Source: Eurostat

4. Comments

Over the period 1985 to 1996 the energy consumption of transport (including marine bunkers and pipelines) has risen 28% (3.1% per year) in the European Union. The total final energy consumption of all economic sectors (including marine bunkers and pipelines) has only risen 13% (1.3% per year) over the same period. The transport share of total final energy consumption was 32.7% in 1996, as opposed to 27% in 1985, although has fallen from a height of 33.5% in 1994.

The major greenhouse gas, carbon dioxide, is directly related to fossil fuel combustion. As mentioned above, a small decrease in the share of transport has occurred over 1995 and 1996. A further reduction could be achieved by various measures, including the greater use of alternative fuels such as LPG and natural gas (see Indicator 10) as well as a shift to more energy-efficient modes and means of transport.

5. Methodological notes and suggestions for future work

The indicator originally proposed was 'Transport share of final energy consumption and of total primary energy consumption'. An indicator on primary energy consumption would provide a better basis for comparing the various modes, in particular because it would also take account of energy used for production of electricity. It is however not currently possible to allocate energy consumption used in primary production (extraction) and transformation (refineries, power generation, etc.) specifically to transport. It would be extremely complex to estimate these data. The indicator is therefore at present confined to final consumption, i.e. the consumption by the final consumer.

Pipelines and marine bunkers are included in this indicator although they are not normally considered under 'final energy consumption'. The energy consumption of pipelines appears in the energy balance under the consumption of the energy branch. In the case of marine bunkers, although this fuel is consumed by maritime transport, it only loosely reflects the maritime activity of the country, and is therefore normally considered as an export of energy. To a lesser extent this is also true for aviation. The exact definition of 'inland navigation' is unclear, and may include coastal shipping. An attempt is being made to clarify this.

The Eurostat series of final energy consumption include data for the territory of the former German Democratic Republic including East Berlin.

Indicator 2: Transport air emissions CO_2, NMVOC, NO_x

1. Purpose and policy relevance

This indicator presents air emissions of significant atmospheric pollutants from transport: CO_2, NMVOC, NO_x.

Emissions to the air from transport contribute to the following environmental problems:

- climate change (greenhouse gases, especially CO_2),
- long range transboundary air pollution both acidification (pollutants like NO_x) and tropospheric ozone (with precursors CO, NMVOC and NO_x) and
- urban air quality (in addition to the previously mentioned gases there are also toxic and/or carcinogenic pollutants like lead, benzene, PAH and particulate matter (measured as PM_{10} and/or $PM_{2.5}$).

These problems are being addressed by a number of policies and measures, and various political emission reduction targets have been set. This is being performed both through

- international conventions: the UN Framework Convention on Climate Change (UNFCCC) and the Convention on Long Range Transboundary Air Pollution (CLRTAP) as well as the EC Monitoring Mechanism for CO_2 and other greenhouse gas emissions
- through the EU framework: 5th Environmental Action Programme (5EAP); the Auto Oil programme and related Directives on emission standards and fuel quality and
- agreement with the car industry on the reduction of CO_2.

2. Emission reductions targets

There are a number of different national and international political targets for reduction of air emissions from all source sectors, including transport. These targets are usually expressed as a percentage reduction of the national total emissions from a base year (often 1990).

There are no internationally agreed reduction targets for the national emissions (by country) from the transport sector, although various Member States have set their own national targets and have introduced specific policies and measures for this sector.

The most important internationally agreed targets are for the EU and its Member States as follows.

- CO_2 (and other greenhouse gases):

  The European Community's political targets within UNFCCC are to stabilise CO_2 emissions by 2000 at 1990 levels and to reduce emissions of the main six greenhouse gases (including CO_2) of the EU by 8% in 2008-2012 (Kyoto Protocol) from 1990 levels. Other European countries have agreed to comparable targets. The Kyoto Protocol has been signed by many countries, but ratified by few and hence is not yet in force.

- NO_x, NMVOC, NH_3 and SO_2 (acidifying gases and ozone precursors):

  The EC's targets are largely based on its commitments within CLRTAP and on ongoing EC strategy developments. In 1997 the European Commission presented its 'EU acidification strategy'. Currently the Commission is developing an EU ozone abatement strategy. In addition UNECE/CLRTAP is preparing a second NO_x Protocol expected to be finalised in 1999, that will be consistent with the approaches used for the EU ozone and acidification strategies. For the EU Member States all these ongoing activities are expected to lead a national emission ceilings Directive for SO_2, NO_x, VOC and NH_3 in 1999.

  The current EU15 (valid for EU15 and the Member States individually) emission targets for SO_2, NO_x and VOC are set in the 5th EAP:

  - reduction 30 % below 1990 levels in 2000 for NOx;
  - reduction 30 % below 1990 levels in 1999 for VOC;
  - reduction 35 % below 1985 levels in 2000 for SO_2.
  - additional targets are set within UNECE/CLRTAP second sulphur protocol which are different for each MS. For the EU15 as a whole this means: approximately 40% reduction of SO_2 from 1990 levels in 2000.

Preliminary targets as proposed by the Commission in the EU Acidification strategy (1997) are as follows (they are expected to be revised and made final in 1999 within the national emission ceiling directive):

- reduction 84 % below 1990 levels in 2000 for SO_2;
- reduction 55 % below 1990 levels in 2000 for NO_x;
- reduction 27 % below 1985 levels in 2000 for NH3

It is anticipated that implementation of the measures developed through the Auto-Oil Programme will lead to emission reductions from the transport sector aimed at reaching the abovementioned national (total) targets, but no specific emission targets for MS have been set within the Auto Oil Programme. The result of the Auto-Oil 1 programme are the following Directives :

- A two-step tightening of vehicle emission limit values for passenger cars and light commercial vehicles with the first step in the year 2000 and the second step in 2005,
- new environmental specifications for petrol and diesel fuels to take effect from the year 2000; very low sulphur fuels to be mandatory from 2005
- provision made for earlier phase-in of very low sulphur fuels

The Auto Oil 2 programme is considering additional measures and will result in Commission proposals for measures in 1999. The national emission ceilings directive (as mentioned above) will be taken into account.

In 1998 the European Commission reached an agreement with the car industry to reduce CO_2 emissions from new passenger cars by 25% between 1995 and 2008. The car industry commits itself to reduce average CO_2 emissions from new passenger cars to 140 g/km by 2008. The Commission’s target is to improve fuel efficiency of passenger cars to 120 g/km.

3. Preliminary compilation of the indicator

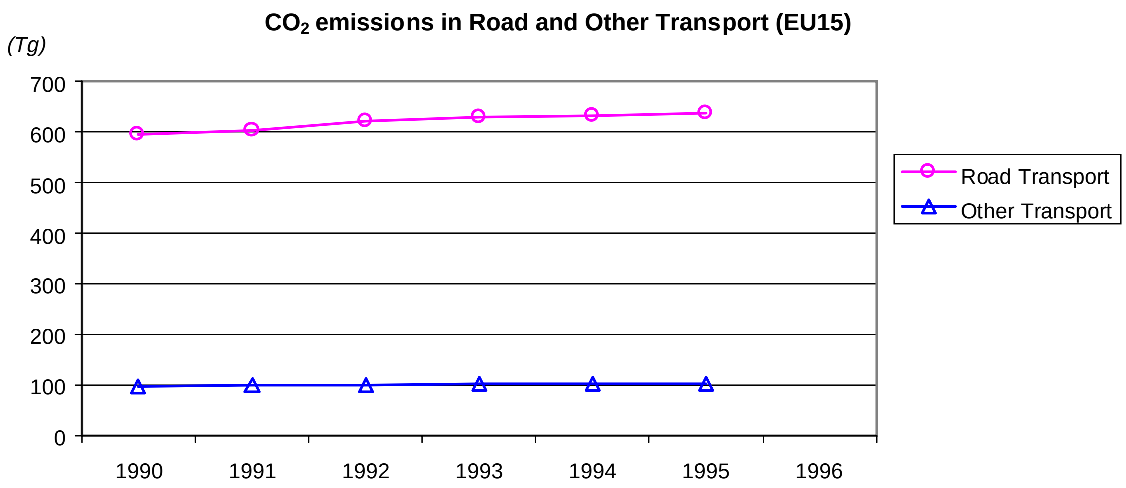
In the figures below, trends are shown of the various emissions by the transport sector, and of the share of transport in total emissions. For CO_2, a comparison is made between data obtained from national reporting to international conventions and the European Commission (DGXI) and Eurostat estimates.

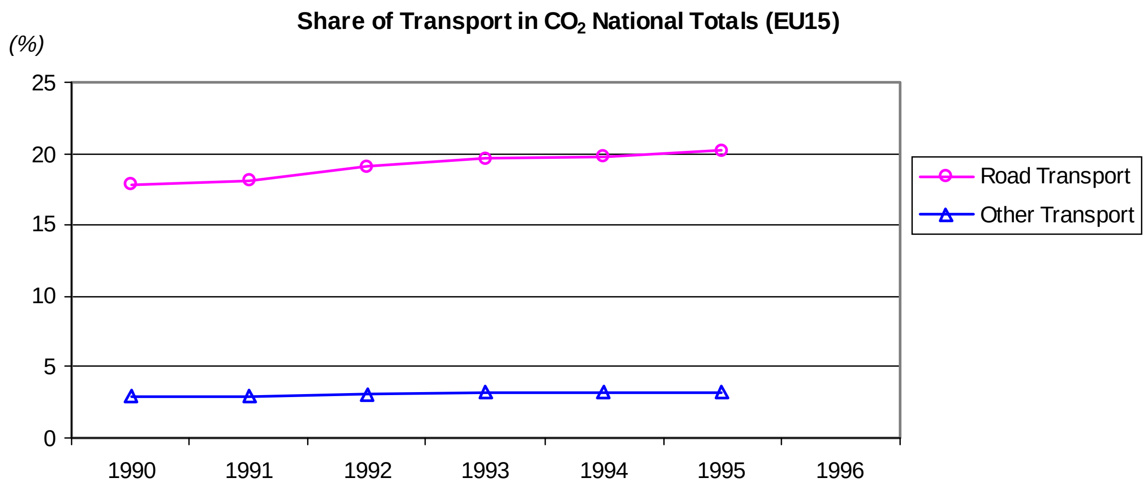
‘Other transport’ is defined as: air, rail, shipping (according to the international reporting obligations).

1 Tg (teragram) = 1 Mt (million tonnes)

1 Gg (gigagram) = 1 kt (kilotonne = 1000 tonnes)

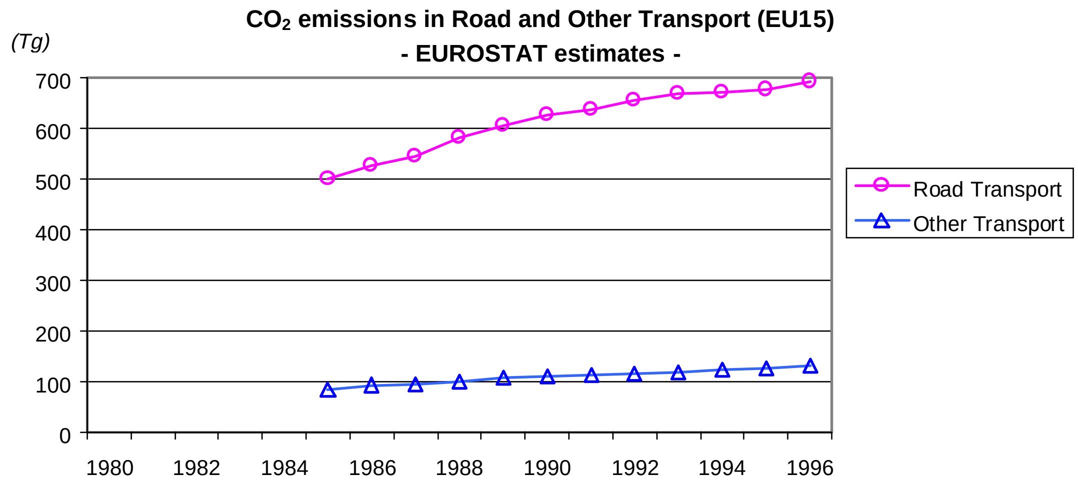
CO_2 emissions: national reporting data

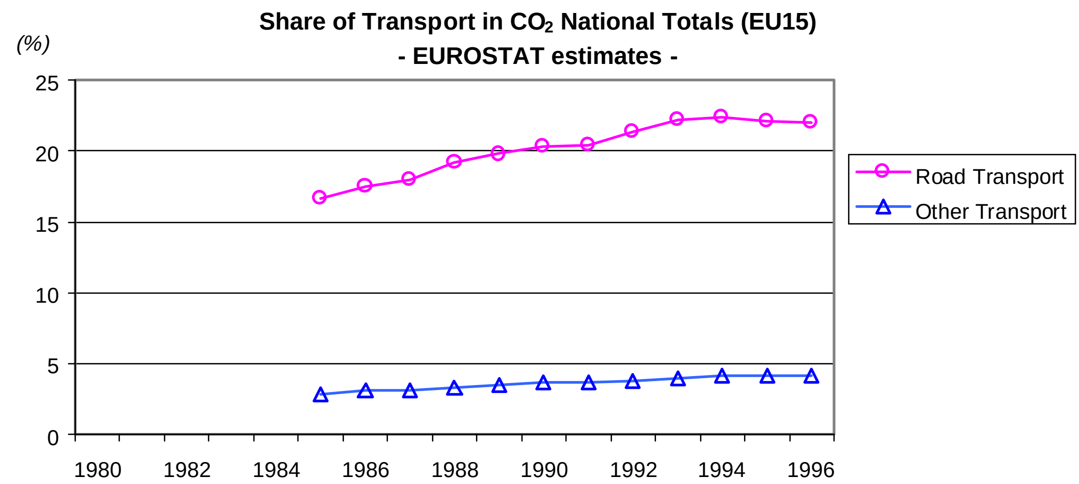




Sources: CLRTAP data (November 1998), UNFCCC data (December 1998), CORINAIR data (February 1999)

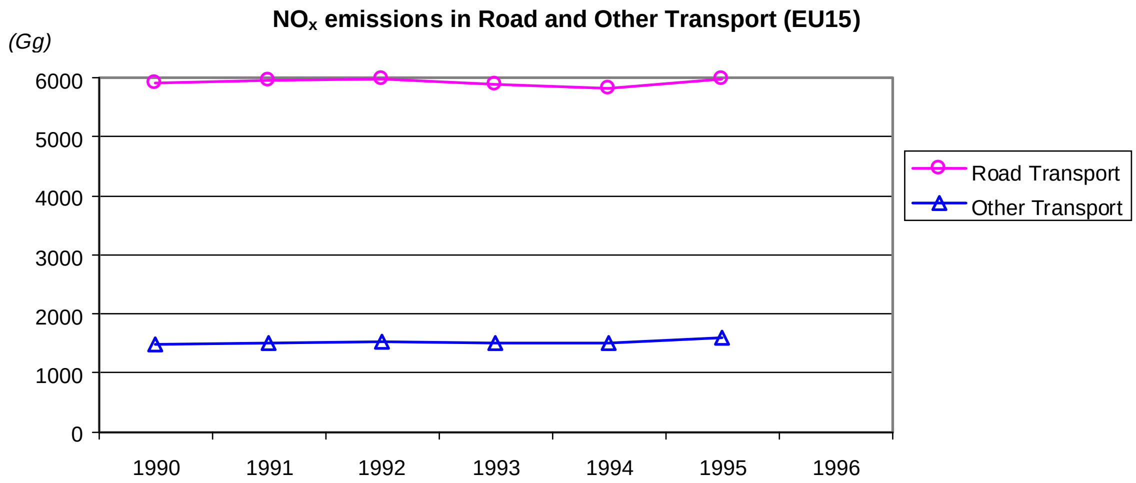
CO_2 emissions: Eurostat estimates

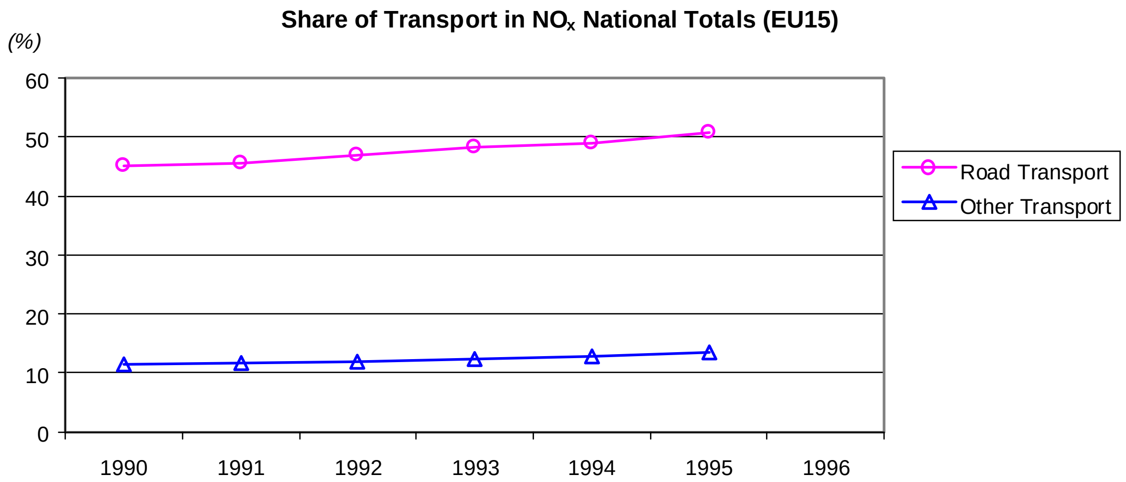




Source: Eurostat

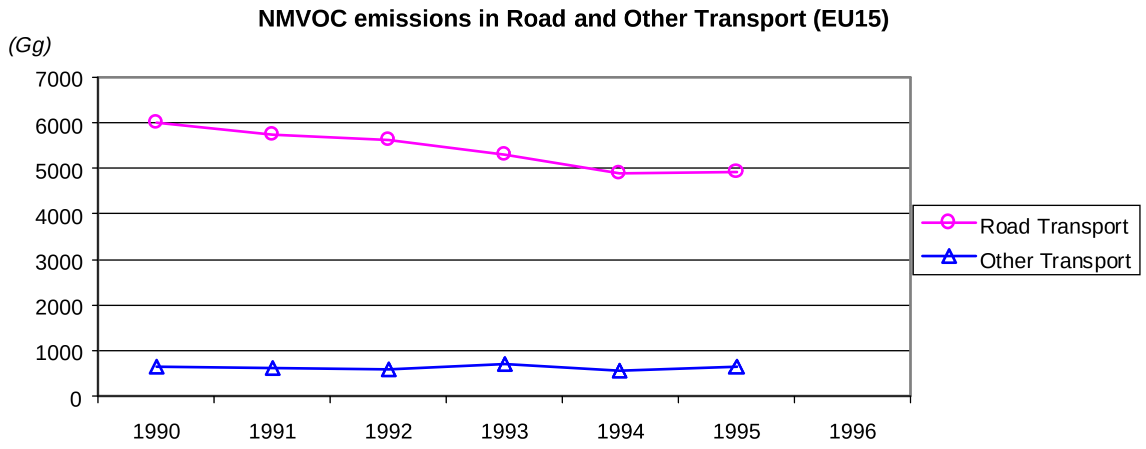
NO_x emissions

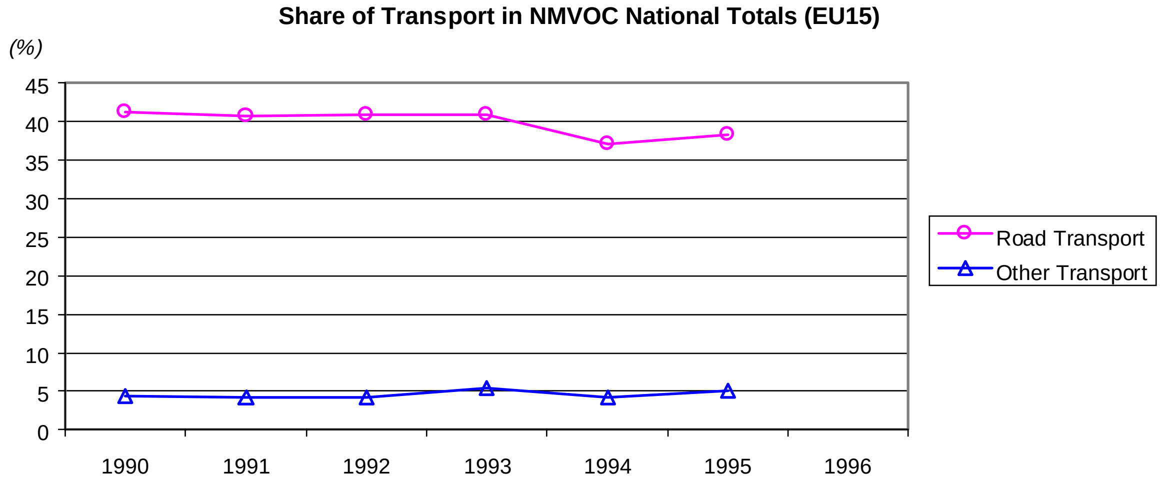




Sources: CLRTAP data (November 1998), UNFCCC data (December 1998), CORINAIR data (February 1999)

NMVOC emissions





Sources: CLRTAP data (November 1998), UNFCCC data (December 1998), CORINAIR data (February 1999)

4. Key message and analysis of trends

4.1. Transport emissions

CO_2 emissions from transport have increased steadily, while NO_x and NMVOC emissions from road transport have been decreasing slightly since peaking in the late 1980s.

The increase in CO_2 emissions from transport is due to the increases in traffic flows. Changes in fuel consumption per vehicle are, as yet, very small and so increased use of vehicles leads directly to increased emissions of CO_2. This is true both for road transport and non-road transport.

The introduction of catalysts on new petrol engined cars and stricter regulations for emissions from diesel vehicles has lead to reductions in the emissions of NO_x and NMVOC from road vehicles. To some extent this has been off-set by the increases in vehicle use and so the reduction in total emissions is relatively small despite the large reductions in the emission rates of new vehicles.

4.2. Share of transport in total emissions

CO_2 emissions from road and other transport have been increasing as a share of total emissions.

Emissions of NO_x and NMVOC from road transport have fallen slightly as a percentage of total emissions after apparently peaking in the late 1980s. It is unclear if there is a significant trend in emissions of NO_x and NMVOC from other transport.

The increase in CO_2 emissions as a share of the total emissions is in line with the increase in energy use as a share to total energy use. This reflects the increasing use of transport, both for passengers and for goods. The population of road vehicles has increased which has contributed to the increased vehicle kilometres travelled and hence energy used.

The small falls in the emissions of NO_x and NMVOC as a share of the total emissions reflect the emission abatement measures that have been fitted to vehicles. This has lead to a reduction despite the increased vehicle kilometres travelled. The largest changes in the EU were the introduction of catalytic converters in the vehicle exhausts of petrol cars. This occurred in the early 1990s stopping the earlier upward trend in emissions.

5. Links with other indicators

Indicator (share of transport to) exceedance of threshold values for air quality.

6. Comments

National reporting rarely offers complete time series for every country. The ETC/AE has prepared estimates for the missing years, mainly based on the available years. This can influences the overall (EU15) trend. The quality of the indicator could be improved by means of improved national reporting and by comparing with 'central' estimates (see also 'future work').

7. Data gaps and methodological notes

This indicator is based on national reporting to international conventions and the European Commission (DG XI). It should be noted that many data before 1990 are missing. Therefore it has not been possible to prepare reliable EU15 estimates before 1990.

The following sources of national reporting were used:

1. Second or first national communications prepared by the Member States under the UN Framework Convention on Climate Change;
2. National programmes and/or national emission inventories under the EC Decision on a Monitoring Mechanism for CO_2 and other greenhouse gases
3. National reporting to the UNECE Convention on Long Range Transboundary Air Pollution
4. EEA/ETC CORINAIR inventory programme of the European Environment Agency. Within this programme Member States have provided sectoral emission inventories for 1990, 1994, 1995 and 1996.
5. Eurostat. Emissions of CO_2 from fuel combustion are estimated by Eurostat, based on Eurostat energy balances, compiled in co-operation with the countries, and harmonised emission factors derived by Eurostat.

These data sets are defined by the reporting formats. The *UNFCCC* and the *CO_2 Monitoring Mechanism* data sets follow the IPCC format, described in the *1996 IPCC Guidelines* [1], whereas the *CLRTAP* and C*ORINAIR* data sets follow the EMEP format, described in the joint EMEP/CORINAIR Atmospheric Emission Inventory Guidebook. The *Eurostat CO_2 estimates from fossil fuels* are compatible with the IPCC 1996 Guidelines [4]. In practice, these formats can lead to different national total estimates. CLRTAP only includes emissions from within the EMEP area (=Europe) while reporting to the UNFCCC can include emissions from anywhere in the world if these are judged as 'national'. Furthermore the UNFCCC format does not include emissions from international air traffic and shipping.

Another difference is the level of detail the data sets provide. CORINAIR is the most detailed but only available for a few years (1990, 1994/1995/1996). Regarding transport emissions, the CLRTAP/EMEP (and Eurostat for CO_2) estimates provide a split in emissions from road transport and from other transport. UNFCCC/IPCC estimates, on the highest aggregated level, only provide emissions from transport as a whole.

8. Future work

Detailed analyses are required that compare estimates prepared by the Member States countries with estimates prepared through harmonised 'central' estimates, in particular the Eurostat TRENDS project as well as the DGXI Auto Oil 2 programme. It is important to analyse in detail which methodologies have been used by Member States (e.g. COPERT, own national approach, etc.) and what, if any, impact this has on the final results.

The results of such comparisons should be communicated with the Member States to improve the consistency, transparency, comparability and reliability of their estimates as well as the acceptance by the Member States of 'central' estimates. Such communication can be done through the EEA's EIONET structure (National Focal Points and National Reference Centres for Air Emission Inventories).

9. References

1. IPCC (1997). Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, Volume I-III. Greenhouse Gas Inventory Reporting Instructions, UNEP, OECD, IEA, IPCC.
2. EEA, joint EMEP/CORINAIR Atmospheric Emission Inventory Guidebook. First edition, 1996.
3. EUROSTAT (1998). Carbon dioxide emissions from fossil fuels 1985-1996, Commission of the European Communities, EUROSTAT.
4. EEA/ETC-AE, Overview of national programmes to reduce greenhouse gas emissions, draft report, 24 February 1999.

Indicator 3: Exceedances of air quality values

1. Purpose and policy relevance

Air pollution on the urban scale is the source of a range of problems both within cities as well as outside as emissions from cities lead to an increase of the regional background concentration levels of many pollutants. These problems include damage to flora and fauna, decomposition of materials, buildings, historical monuments, weather and climatic changes and most important health risks mostly associated with inhalation of gases and particles.

Although air quality in Europe and particularly in the large European urban areas has improved in recent decades, nearly 40 million people residing in the 115 larger European cities still experience exceedance of the WHO air quality guidelines for at least one pollutant every year (EEA, 1998a).

Solutions to air pollution is directed towards either a health problem, towards ecosystem protection or a combination of the two. Related to transport combustion in vehicle engines is the dominating source for various pollutants. Also traffic related activities such as the extraction, refinement and distribution of petroleum products results in pollutant emissions.

National and EU-level regulations aiming at automobile emissions reduction, such as introduction of catalytic converters (EC Directive 91/441/EEC), or unleaded petrol (EC Directive 85/210/EEC), resulted in considerably lower vehicle emission factors. The continuous expansion of the vehicle fleet, however, wrestles these improvements.

Controlling air pollution from road traffic (e.g. NO_x, NMVOC and indirectly O_3 levels) is identified as the single biggest and most complex issue (CEC-DGXI-The European AQ Management Project). A variety of methods include improving public transport, diverting traffic from city centres by building ring roads, reducing car use by means of parking policies or stimulating bicycle use, have been used for dealing with the problems caused by the ever increasing number of car on the roads of Europe with varying degrees of success. The result is a modest and statistically disputable downward trend in NO_x and O_3 levels from 1990 to 1995.

At the European level the Commissions approach towards transport emissions has been through the Auto Oil Programme 1 which is completed, and the Auto Oil Programme 2 with its proposed follow-up programme Clean Air for Europe. The various protocols under the Geneva Convention are important for reducing traffic emissions with reduction commitment on specific pollutants. Decisions under the Framework Convention on Climate Change also have an impact in that measures to reduce emissions of greenhouse gases will at the same time reduce emissions of other compounds.

2. Targets

The target of mitigating action towards air pollution is reduced damage. The World Health Organisation (WHO) has recommended threshold concentrations for a range of air pollutants indicating safe air quality levels. Various policy actions at EU and national level have taken these into account. At the EU level the Framework Directive on Ambient Air Quality (96/62/EC) defines in the preamble its objective 'in order to protect the environment as a whole and human health, concentrations of harmful air pollutants should be avoided, prevented or reduced and limit values and/or alert thresholds set for ambient air pollution levels'. Limit values and alert threshold for a list of 13 pollutants have been decided upon or is in the process of being decided.

Within the Convention on Long-Range Transboundary Air Pollution (CLRTAP) the concepts on critical loads are developed with air pollution deposition. At the EU level a Community strategy to combat acidification (COM (97) 88) has been proposed with an ultimate objective of no exceedance of critical loads and interim targets on the path to reaching that goal. Similarly a CLRTAP multi-pollutant multi-effect Protocol in preparation will provide national targets towards no exceedance of critical acidifying loads, critical eutrophying loads as well as ozone threshold values.

The pollutants initially relevant within the context of TERM should be nitrogen dioxide, ozone, carbon monoxide, lead, benzene and inhalable particulate matter, all of which have traffic as the dominating source sector.

Pollutant	Usual short-name	Emission compounds	EU Limit Value averaging time
Nitrogen dioxide	NO_2	NOx, i.e. NO and NO_2	1h and year
Ozone	O3	NOx, CO and VOCs	CEC Proposal expected by April 1999. WHO recommendations at: 1h, 8h, 24h, year, accumulated exposure
Carbon monoxide	CO	CO	8h
Lead	Pb	Pb	year
Benzene	Benzene	Benzene	year
Inhalable particulate matter	PM10	Particulates	24h and year

3. Methodological notes and suggestions for future work

3.1. Developing the indicator

Three levels of refinement may be distinguished for the indicator. Each level requires a more elaborate calculation from the previous.

Level 1: Concentrations of pollutants relative to the EU air quality limit values, or expressed as the maximum exceedance ratio compared to the air quality limit value

Level 2: Number of people exposed to exceedances of the air quality limit values.
&
Total area exposed to exceedance of critical values on tropospheric ozone, eutrophying nitrogen or, acidifying nitrogen.

Level 3: Exceedances of the air quality limit values; accumulated potential population exposure by number of people, time and exceedance.
&
Exceedance of critical values on tropospheric ozone, eutrophying nitrogen or, acidifying nitrogen; accumulated exposure by area, time and exceedance.

3.2. How to take account of the transport share

At the present no analysis is available with a discrimination of transport share to pollutant level. However, the list of pollutants proposed for use within TERM are limited to compounds for which transport is the main contributor to the emissions or precursor emissions.

The EEA Generalised Empirical Approach to the Auto Oil 2 Programme will for the first time produce results discriminating the transport share at the European level. The indicator used could be from calculating the reduction needed to have non-exceedance of guideline values when the three emission categories transport, industry and other are reduced by the same amount in percentage term.

3.3. The spatial resolution

A selection of representative cities at the European level has been made as part of EEA Generalised Empirical Approach to the Auto Oil 2 Programme. It is proposed to apply the same selecting within TERM.

3.4. The temporal resolution

will vary with compound and pollutant guideline. A selected set of guidelines or limit values will be used. A maximum number of two guidelines per pollutant is recommended.

4. Preliminary compilation of indicator

The assumption that traffic is the dominant source sector for certain pollutants in urban areas is illustrated with a figure from 'Air Pollution in Europe 1997'.

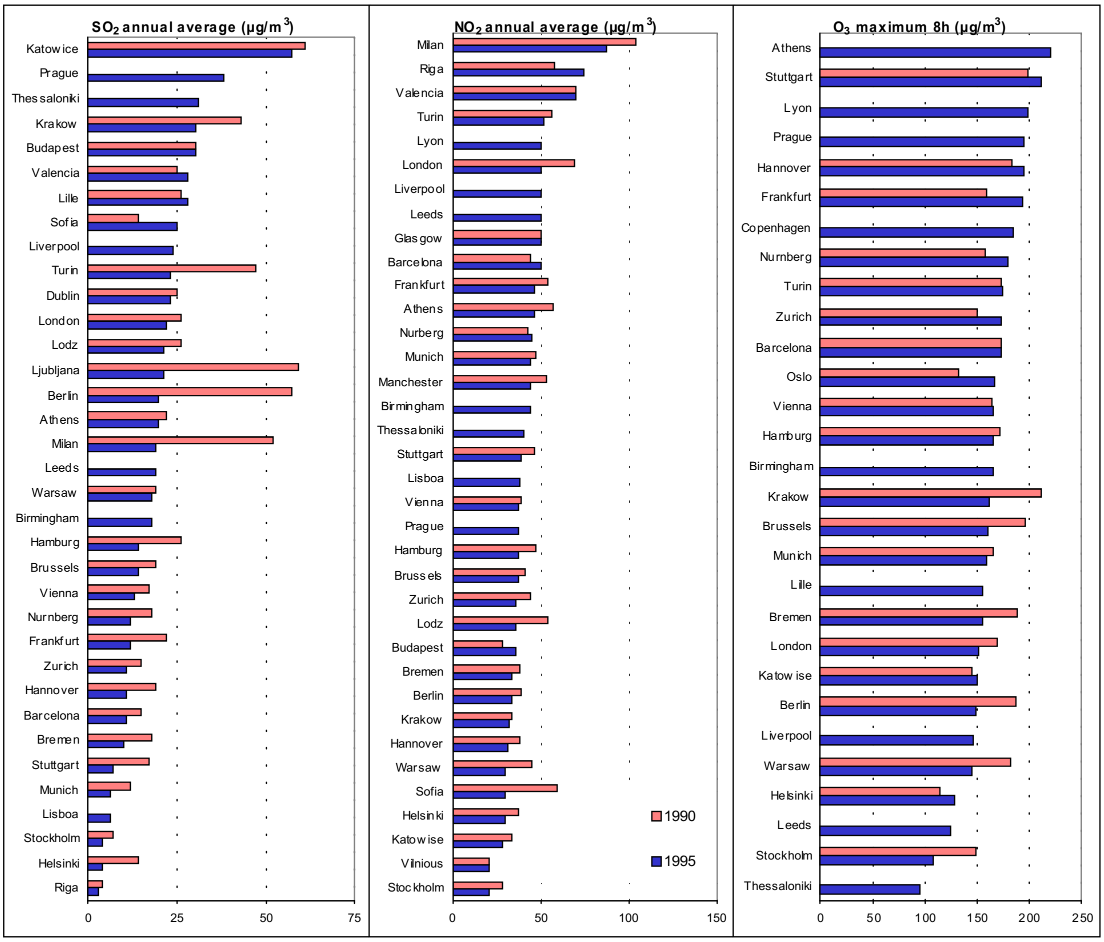
The indicator at level 1 has been published by EEA several times. Data are presently available for time series of five years resolution. Data availability is expected to improve. The latest examples are:

- Various pollutants from draft EU98 report (Figure 1);
- NO_2, O_3 city list from draft EU98 report (Table 1);
- example of urban exceedance map from 'Air Pollution in Europe 1997' (Figure 2).

The indicator at level 2 has also been used in EEA reporting although not yet as time series.

No examples is yet available for indicators at level 3. The method is still to be developed and tested. The results of the Auto Oil 2 Programme available within June 1999 will determine how to further the approach.

Figure 1: ***Annual average SO_2, NO_x and maximum 8-hour O_3 concentrations for a number of large European cities***



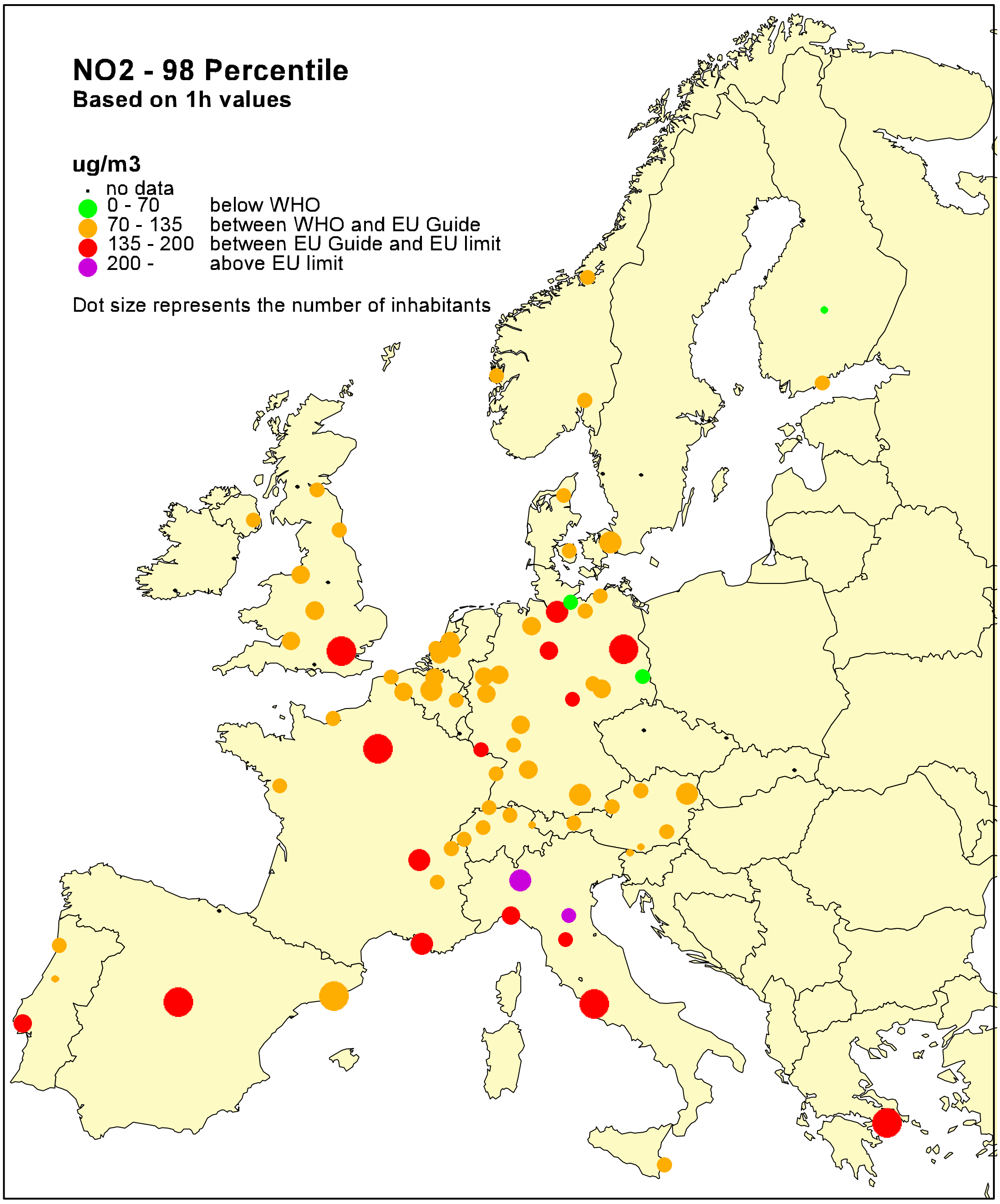
Source: EEA, 1999 (in press)

Table 1. Air quality: Urban air quality trends

	EU15		Accession	
Indicator	1990	2010	1990	2010
Emission per capita				
Sulphur dioxide (kg)	35	14	120	38
Nitrogen dioxide(kgNOx)	29	15	39	21
Benzene(kg)	0.9	0.19	0.84	0.22
PM10(kg)	3.0	4.0	11.7	9.5
B(a)P(g)	0.79	0.66	0.97	0.83
Average population weighted concentration				
Sulphur dioxide (max. day, ug/m3)	244	99	822	369
Nitrogen dioxide (annual average, ug/m3)	57	41	59	58
Benzene (annual average, ug/m3)	8	3	12	4
PM10 (annual average, ug/m3)	42	29	68	44
Ozone (max. hour, ug/m3)	289	253		
Ozone (AOT-60,ppm.hr)	8.3	3.2		
B(a)P (annual average, ng/m3)	2.7	2.1	6.2	5.3
Average exposure				
Sulphur dioxide	80%	11%	96%	75%
Nitrogen dioxide	85%	54%	98%	90%
Benzene	58%	17%	83%	26%
PM10	58%	17%	97%	60%
Ozone	82%	73%		
B(a)P	80%	60%	81%	79%
Average exceedance (ratio, compared to threshold value)				
Sulphur dioxide	1.8	0.2	6.1	4.3
Nitrogen dioxide	1.4	0.7	1.5	1.4
Benzene	1.6	0.1	2.4	0.1
PM10	0.8	0.2	1.7	0.8
Ozone	0.7	0.5		
B(a)P	2.9	2.0	7.2	6.2
Maximum (2x2 km^2) exceedance (ratio, compared to threshold value)				
Sulphur dioxide	2.3	0.3	7.3	5.6
Nitrogen dioxide	1.5	0.8	1.6	1.5
Benzene	2.0	0.1	2.9	0.1
PM10	0.9	0.2	2.0	1.0
Ozone	1.0	0.7		
B(a)P	3.4	2.4	6.2	6.5

Source: EEA 1999 (in press)

***Figure 2:** Exceedances of EU Limit values for NO_2 (98 percentile, 1h values) and Guide values (50 percentile, 1h values) in cities (1993). For each city the site with highest measured values was chosen. Data for 50 and 98 percentiles was available for about 220 and 330 sites. Source: 'Air Pollution in Europe 1997'. EEA Environmental Monograph No. 4.*



5. References

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European Environment Agency (1997), Air Pollution in Europe 1997, EEA Environmental Monograph No. 4

European Environment Agency (1998), Assessment and Management of Urban Air Quality in Europe, EEA Monograph N° 5

Indicator 4: Exposure of population to traffic noise

1. Purpose and policy relevance

Although noise is associated with all human activities it is caused mainly by the various transport modes i.e. road, air and rail traffic. Road traffic is by far the major noise source. Aircraft and rail noise levels can be very annoying too, but far fewer people are involved. Also, noise perception is quite different for the various sources: e.g. the same noise level, road traffic noise is perceived as more annoying than railway noise.

Noise can affect people in both physiological and psychological ways. At levels over 40 dB(A) it starts to influence our well being, at levels over 60 dB(A) it may well be detrimental to health (WHO 1995). Noise can also have an effect on nature: for the total of EU-15, it was estimated (EEA 1999) that the impact of road traffic noise in terms of areas exposed to 47 dB(A) Ldn, which can disturb nature life (and especially the breeding of birds), is estimated to be approx. 7% of the total EU-15 area.

To date, Community noise policy has essentially consisted of directives fixing max. sound levels for vehicles, aeroplanes and machines with a single market or social policy aim. The Commission's Green Paper on a future Common Noise Policy (COM(96) 540 final) already underlined the need for a more comprehensive EU strategy for noise policy. However, till now no common noise assessment system for the EU is available. The main reason is a lack of harmonisation both in noise measurement and assessment indices and methodologies throughout Europe. The Common Noise Policy is currently being prepared, and will be established in a coherent system of directives consisting of a framework directive for environmental noise and directives on noise emission. Various Noise Policy Working Groups (WGs) have started dealing with issues that need to be clarified and harmonised throughout Europe such as indices/indicators, dose/effect relationship, computation and measurement, noise maps, noise abatement and emission control.

2. Targets

The 5EAP targets for noise exposure to be reached by 2000 and a recent proposal on the review of the 5EAP announced the development of a noise abatement programme for action to meet these targets. Main objectives are:

- No person should be exposed to noise levels which endanger health and quality of life
- Exposure of the population to noise levels in excess of 65 dB(A) LA,eq (night) should be phased out
- At no point in time a level of 85 dB(A) LA,eq (night) should be exceeded
- The proportion of population at present (1993) exposed to levels between 55 and 65 dB(A) $L_{A,eq}$ (night) should not suffer any increase and the proportion of population at present exposed to levels less than 55 dB(A) $L_{A,eq}$ (night) should not suffer any increase above that level

It is expected that the future Common Noise Policy will define its targets using the Lden index, so at present analysis related to the LA,eq (night) is not very useful since the LA,eq (night) cannot be converted into the Lden. The targets cannot be reformulated without changing their impact so this is an issue to be resolved.

3. Preliminary compilation of the indicator using the EU99 SoER approach

The assessment for the EU99 SoER (*Environment in the European Union at the turn of the century,* EEA, 1999) made use of the latest national results and calculations, and is therefore used as a first basis to illustrate possible TERM noise indicators. In this report, EEA decided to present the assessment on the state of the acoustic environment in Europe by using the Ldn index instead of the Leq previously used in the first European estimation (Inrets study for DGXI, Nov. 1995). This is very close index-wise to what is developing to become a standard European noise index value.

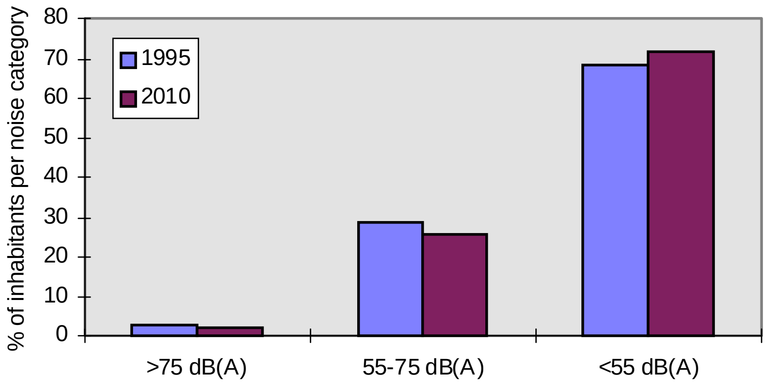
3.1. Road traffic noise

The model for the calculation of the number of inhabitants of the EU exposed to road traffic noise levels (L_{DN}) exceeding 55 dB(A), 65 dB(A) and 75 dB(A) is outlined below:

- Based on statistics from Denmark, France, Greece, the Netherlands, Spain and Sweden, it is concluded that the relative amount of exposed people is larger in cities with a larger amount of inhabitants. People living in the rural areas of countries are the least exposed to road traffic noise.

- Five city types are defined with different distributions of the number of exposed inhabitants to levels >55, >65 and >75 dB(A).
- The inhabitants of EU15 countries are divided over urban and rural areas based on UN statistics (United Nations Population Division, World Urbanisation Prospects, The 1996 Revision, UN, New York).
- Based on statistics provided by EUROSTAT the population of the urban area of each country is distributed over several classes of city sizes.
- The available exposure statistics for several countries and cities, as well as the calculated values for the exposed inhabitants of Munich, Madrid and Amsterdam (M+P and Muller BBM report prepared for European Environment Agency, 1998) were used as calibration and verification values for the estimation.

Figure: Percentage of inhabitants exposed to Ldn noise categories for Amsterdam, Munich and Madrid, for the year 1995 and 2010



In this way all inhabitants of the EU, including those living in the rural areas, are approx. distributed over 3 noise-exposure classes:

Ldn dB(A)	< 55	55-75	> 75
% EU-15 exposed	68	30	2
population (millions)	251	112	8

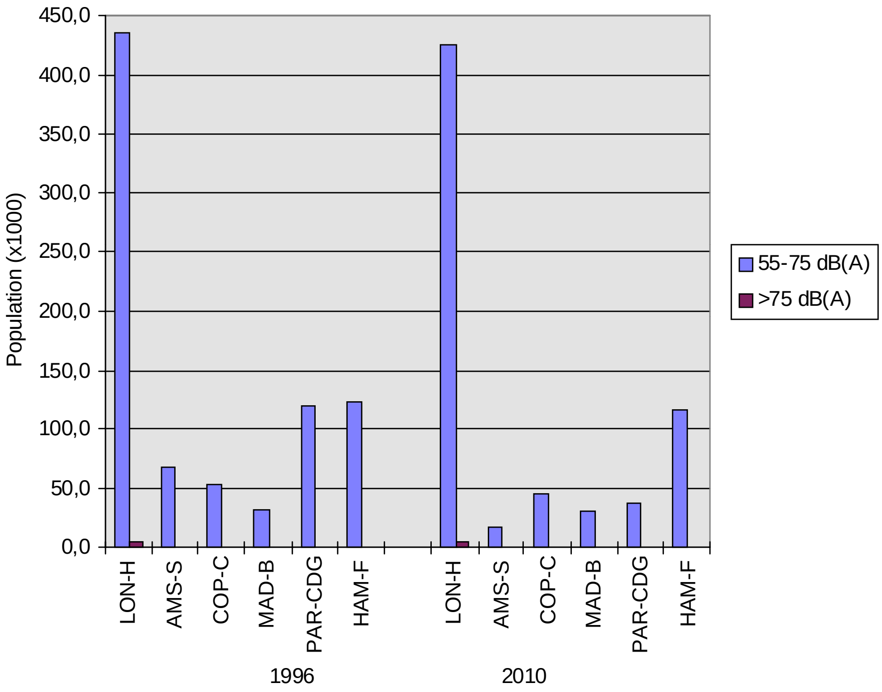
3.2. Aircraft noise

Aircraft noise differs in that compared with road traffic, it affects less people, but more intensively, to a certain extent.

The EU99 SoER estimates have been made using the following approach:

- For 6 selected European airports, London Heathrow, Madrid Barajas, Paris CDG, Copenhagen Kastrup, Amsterdam Schiphol, and Hamburg, an assessment of aircraft noise was performed. These airports differ considerably, not only in the magnitude of traffic and fleet mix, but also in their lay-out in respect to noise sensitive areas.

Figure: ***Population in Ldn 55, 65 and 75 dB(A) contours around the 6 studied airport. Existing situation and 2010 forecasts***



- The above situation for the selected airports is extrapolated for the EU-15, 1995 and 2010 time scenarios, based on analysis of the location and number of passengers in 35 major European airports which accommodate about 85% of the total European air traffic :

	Population (in millions) affected by aircraft noise in major airports	
Ldn dB(A) levels	55-75	> 75
total EU-15 (1995)	2,72	0,02
total EU-15 (2010)	2,81	0,02

It is estimated that no significant change is expected between the year 1995 and 2010 mainly due to the results of the noisy 'chapter 2' aircraft phasing out, scheduled fleet renewal and noise optimisation of flight procedures and air strip geometry.

3.3. Rail noise

According to the most recent information (J.Lambert et al, 1998), an estimation regarding the European population exposure to noise from railways based on data from Germany, France and the Netherlands is presented in the table below.

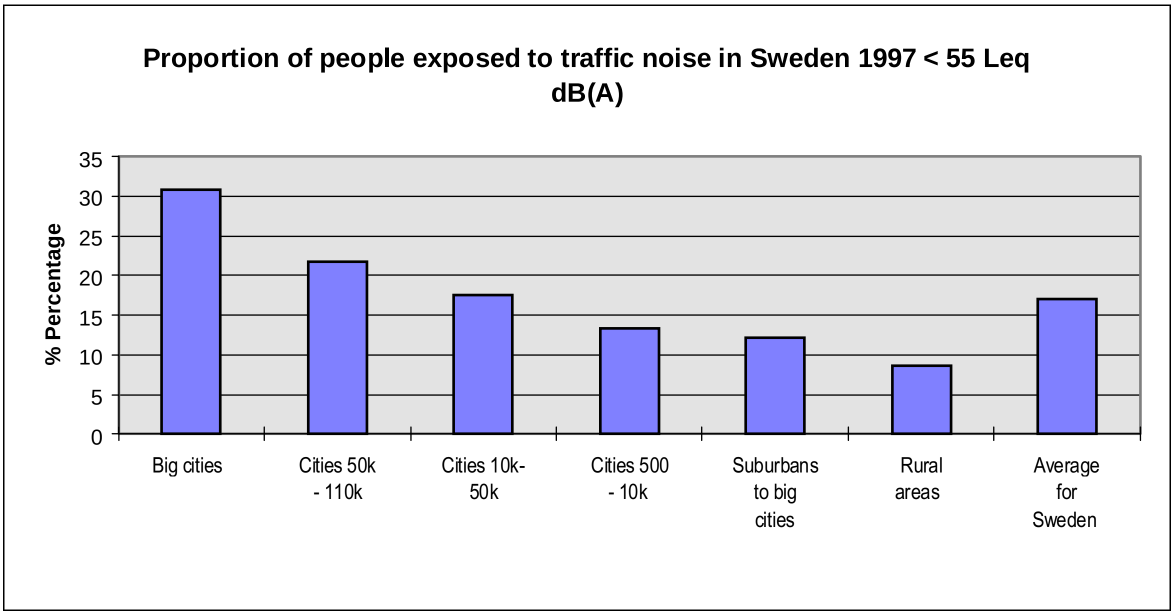
Leq dB(A) daytime	55-75	> 75
EU-15 population (%)	9,7	0,05

Noise control technology has been applied to most high speed trains and many modern normal speed passenger trains, but not on freight trains which remain the major cause of railway noise problems. However, modern technology applied to track and vehicles, above all improved brakes, can reduce noise emissions from rail traffic by more than 20 dB(A) in the long term.

4. Methodological notes and suggestions for future work

Bearing in mind the limitations outlined earlier, any indicator-based evaluation of the current state of the acoustical environment in Europe is necessarily indicative rather than a specific method based on agreed and systematic national data.

Several countries already have established systems for monitoring noise nuisance. For example in Sweden the highest equivalent level of traffic noise (outdoors close by residents' facades) that is considered to be good environmental quality is set to 55 dBA. The following chart shows the distribution of population exposure for the different city size categories. (Source: SWEIONET, Swedish Environmental Protection Agency, 1998).



However, no common and /or agreed noise indicator or time series for noise data at European level are available. developing a TERM noise indicator will therefore be a long-term activity, which will require in-depth investigation, and for which appropriate resources have to be identified. The following gives some ideas on how progress can be achieved.

As a start, an identification has to be made of what is needed in terms of acoustical environment information. The next step would be to develop methods to estimate this by calculation. As issues such as what kind of information, how, when etc. will be dealt with, it should be possible to direct and advise the national administrations on the process to gradually carry out the harmonized information needed.

It is therefore proposed to start by expanding and refining the work done for the EU99 SoER noise assessment. Possible examples of indicators are:

- The number of inhabitants of the EU15 with possible health problems caused by noise exposure
- The number of inhabitants of the EU15 who claim that their quality of life is decreased due to exposure to noise levels

or

- The number of inhabitants of the EU15 exposed to transport noise exceeding x/y/z dB(A) in morning/evening/night period (i.e. the WHO guidelines)
- The number of inhabitants of the EU15 annoyed/highly annoyed by road/air/rail traffic
- The amount of public money spent in the EU15 on noise abatement measures, etc.

or

- PPI (Population per Passenger Index) for road/rail/air traffic noise[21]
- PTI (Population per Ton Index) for road/rail/air traffic noise[3]

It will be extremely useful for the EEA to get feedback from the Noise Policy Working Groups. It might also prove useful if the Noise Policy WGs became acquainted with the idea of developing such indicators for the EU and try to include in their specific field the DPSIR analysis approach.

It might also prove necessary to define different 'level windows' for the different means of transport, or to use an indicator which compensated for the differences in dose/effect relationships for air, rail and road traffic. Finally, co-ordination has to be established with ongoing studies and research from the Commission and other institutions (e.g. the COMMUTE and TRENDS projects).

5. References:

1. Lambert J. and Vallet M., ‘Study related to the preparation of a communication on a future EC noise policy’, LEN Report 9420, December 1994
2. Berglund B. and Lindvall T., ‘Community Noise’, Document prepared for the WHO, Stockholm University and Karolinska Institute, Archives of the Center for Sensory Research, Vol. 2, Issue 1, 1995
3. Blokland G.J., Beckenbauer Th. et al, ‘Present state and future trends on transport noise in Europe’, Report prepared for the European Environment Agency, M+P Raadgevende ingenieurs bv and Muller BBM, March 1998
4. J.Lambert, P.Champelovier, J.Vernet, ‘Railway noise annoyance in Europe : An Overview’, INRETS, Proceedings Euro-Noise-98, Munchen, 1998
5. Miljønyt ‘ Begraensning af trafikstj’ Trafikminsteriet, COWI, nr 30, 1998
6. European Environment Agency (1999, in press), Environment in the European Union at the turn of the century, Copenhagen

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[2] PPI can be defined as the ratio of the number of people annoyed by transport noise and the number of passengers in the specific transport mode. This indicator shows the effect of mobility for different transport modes with respect to the noise exposure. It can be a general one as well (transport) combining all the modes

[3] PTI can be defined as the ratio of the number of people annoyed by transport noise and the amount of tons of freight in the specific transport mode. This indicator shows the effect of freight transport for different transport modes with respect to the noise exposure

Indicator 5: Infrastructure influence on ecosystems and habitats ('fragmentation') and proximity to nature conservation sites

1. Purpose and policy relevance

The two indicators that are investigated in this can be used to evaluate the influence of transport infrastructure on important ecosystems and habitats and on sites of nature conservation interest, i.e. key issues for sustainable biodiversity.

The increasing demand for space for agriculture, forestry, recreation, tourism, transport, housing, industry etc. leads to breaking up of previously large habitats or lands into smaller parcels, i.e. to a human-induced **fragmentation** of habitats accompanied by increased influences from adjacent intensively used areas on smaller and smaller semi-natural and natural areas. The effects on biodiversity are : reduced habitat size and increased distance between suitable habitats for some species (barrier-effect), with detrimental consequences on the sustainability of core characteristic species and of species requiring large areas to survive; also to an increase of the ratio perimeter/area which facilitates the settlement of edge species. Disturbance and noise is also increasing steeply with fragmentation as is the area exposed to chemicals and pesticides and are opened to invasion of other species. Thus combined and multifactorial influences from fragmentation constitute a major pressure complex.

A number of EU regulatory and policy instruments are aimed at protecting the region's biodiversity in different ways. The NATURA 2000 Network for protection of habitats and species is expected to become operational within the outlook period, with upwards of 10% of the EU territory designated for nature conservation purposes and with provisions for protecting species populations.

The Convention on Biological Diversity (CBD) is a central element to the world community's action for sustainable development. It represents a major framework for developing integrative approaches of biodiversity into sectors. An important aspect developed within the Convention is the ecosystem approach (Lilongwe, Malawi workshop, 26-28 January 1998) including twelve basic principles as a conceptual background for land management planning, taking into account the importance of biodiversity for ecosystem functionality.

As a contracting party to the Convention, the EU has developed a European Community Biodiversity Strategy (adopted by the European Parliament in October 1998). In the Strategy, eight 'sectors' or policy areas of relevance to biodiversity are highlighted: conservation of natural resources, agriculture, forestry, fisheries, regional policies and spatial planning, transport and energy, tourism, development and economic co-operation. In the next few years the strategy shall now to be implemented through Action Plans.

At Pan-European level, the Pan-European Biological and Landscape Diversity Strategy (PEBLDS) intends to provide a framework for co-ordination between European States on various actions (on species, ecosystems, landscapes, public awareness).

2. Targets

The targets cover several types of areas of importance for nature conservation :

- areas designated for nature conservation purposes : areas designated under the Community Directives 79/409/EEC (Birds Directive) and 92/43/EEC (Habitats) as well as areas designated inter-nationally and nationally for nature conservation purposes,
- major natural and semi-natural ecosystems and habitats,
- areas described for nature content under the CORINE Biotopes project.

3. Preliminary compilation of the indicators

Several approaches towards indicator development for impacts on biodiversity have been developed by EEA in the context of the forthcoming EEA report 'Environment in the European Union at the turn of the century' and will continue to be developed as part of the EEA Indicator project and the report on Europe's Biodiversity, both under development. EEA's indicator development on indicators on biodiversity is being co-ordinated with EUROSTAT and OECD. At present an approach towards global biodiversity indicators is being developed under the CBD. EEA assists the Commission DG XI in this matter.

The two approaches that are presented below have also be successfully applied by EEA in the methodological study concerning the spatial and ecological assessment of the TEN. They will be presented both in the EEA's 1999 SoE report *Environment in the EU at the turn of the century* and in the CD- ROM 'NATLAN' to appear in 1999.

3.1. Infrastructure Influence on ecosystems and habitats ('Fragmentation').

Several types of fragmentation maps are currently under development in Europe by different projects, showing somewhat different perspectives. The user should therefore be careful to understand the definitions and the data used for each map.

A fragmentation indicator has to take both size, ecological quality and the relations to other nature areas into account. The size of a unit can be graphically determined, to assess its ecological quality is somewhat more difficult. Quality evaluation can be based on e.g. the proportion of the land unit area that is designated by international conventions and on the proportion of the land unit area that is covered by forest or semi-natural habitats.

For the EU SoE 99 report, the EEA developed a **fragmentation index of natural and semi-natural areas by human activities** (combination of urbanisation, transport and intensive agriculture). This is demonstrated in Figure 1.

3.2. Proximity of infrastructures to sites of importance to nature conservation.

- The proposed 'proximity' indicator which was developed by EEA for the TEN is used as an example (Table 2). The influence zone of the TEN is represented as a 10 km buffer zone around the infrastructure centre lines (the width of the buffer can be varied). An area or site is considered at risk if its circular boundary falls within this buffer.
- Although there are many efforts ongoing to digitise the precise boundaries of many types of sites, the spatial information available at this time was limited to the site's centre point, co-ordinates and surface area. In maps, the sites are represented symbolically by a circle with a radius which is proportional to the site surface.
- It is important to note that there are wide overlaps of areas designated for different purposes just as there is between areas designated and areas of high value such as CORINE Biotopes.
- It is also important to note, that there is a span of around 15 years between the oldest and the newest information available at the moment.
- As there is no detailed information on species and habitat distribution within the sites, this 'proximity' indicator only gives an impression of potential conflict rather than relate to a physical or ecological process.

4. Methodological notes and suggestions for future work

Developing TERM indicators to evaluate the transport sector's impact on biodiversity will require additional methodological investigations. The choice and development of biodiversity indicators need careful co-ordination, since several other indicator initiatives for biodiversity are ongoing at international level as well as in most Member States. At European level, the European Environment Agency, EUROSTAT and OECD are involved with Member States in developing indicators suitable for the environmental reporting process. At global level biological indicators are discussed by the SBSTTA (Subsidiary Body on Scientific, Technical and Technological Advice) of the Convention on Biological Diversity.

There are 5 major improvements desirable for enhancing the indicator 5:

- digitalisation of area information on designated areas
- updated information on designated areas
- updated Land Cover information
- updated information similar to CORINE Biotopes
- development of habitat distribution maps with more details than Land Cover

Table 2: Proximity of existing TEN road and rail links to internationally designated areas (% of sites within 10 km)	
S.P.A	53
Barcelona C. site	43
Eurodiploma site	44
Biosphere reserve	52
World heritage	20
Ramsar C. Site	71
CORINE Biotopes inventory	49
Important Bird Area	51

Source: EEA (1998), Spatial and Ecological assessment of the TEN: demonstration of methods and indicators

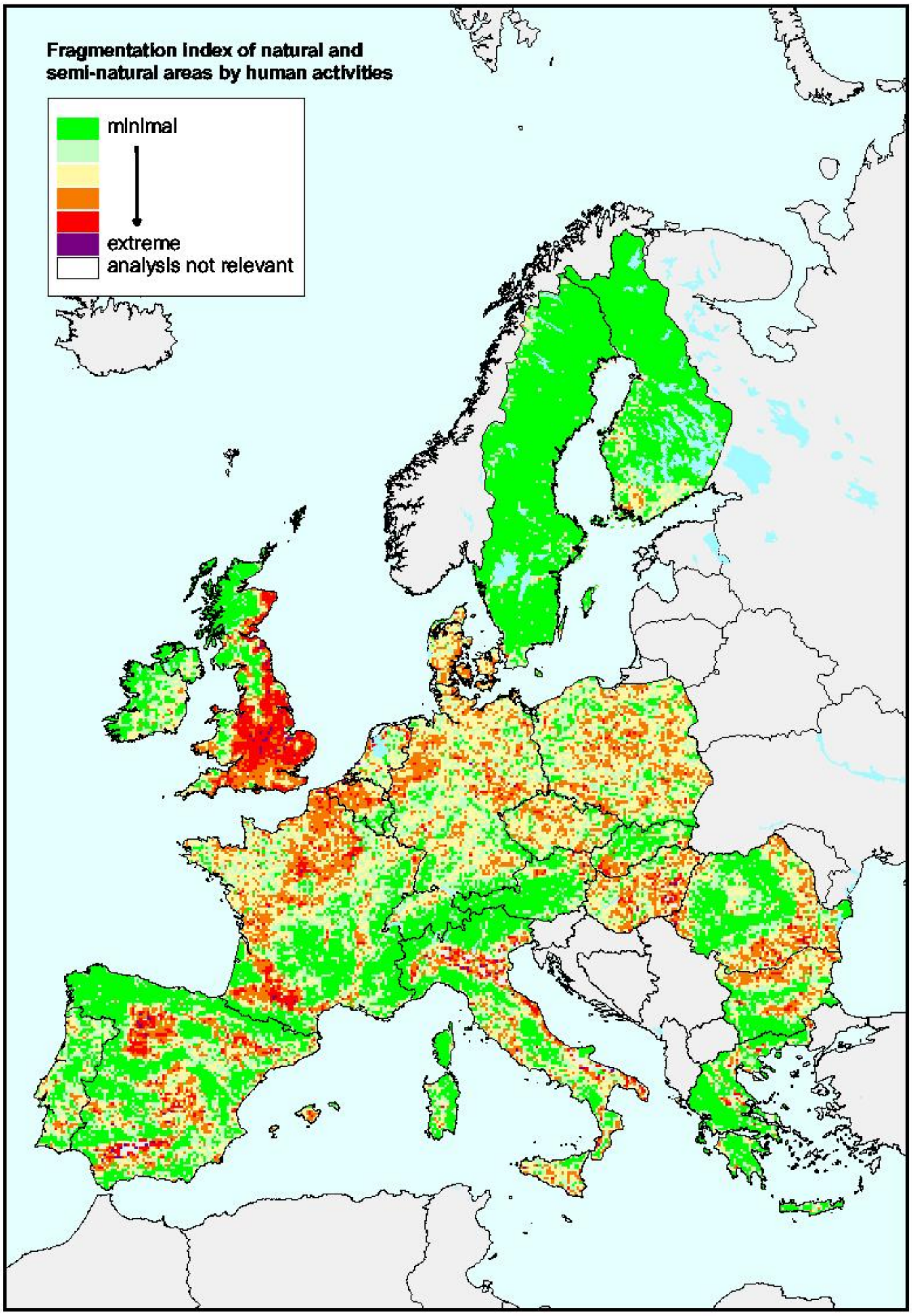
5. References

European Environment Agency (1998), Spatial and Ecological assessment of the TEN: demonstration of methods and indicators

EEA: NATLAN Final Report. Map production and Spatial Analysis

European Environment Agency (1999, in press), Environment in the European Union at the turn of the century, Copenhagen

Figure 1: Fragmentation index



Source: EEA, 1999 (in press)

Indicator 6: Land take for transport by mode

1. Purpose and policy relevance

Land take for transport by mode is considered as potentially indicating adverse environmental impacts. For example, land take in natural areas may lead to a decrease of biodiversity (see also indicator on habitat fragmentation). Land take in urban areas could represent the risk of impacts on humans (safety and noise). It could also be an indicator for urban sprawl. The use of agricultural or forestry land could be considered harmful for nature in general, for landscape or even certain economic activities.

In Europe, land resources are relatively scarce, and reaching a sustainable balance between competing land uses is a key issue for all development policies. New initiatives, such as the European Spatial Development Perspective, will specifically address the impact of European policies, including transport, on the European territory for better spatial planning (EC, 1997).

2. Targets

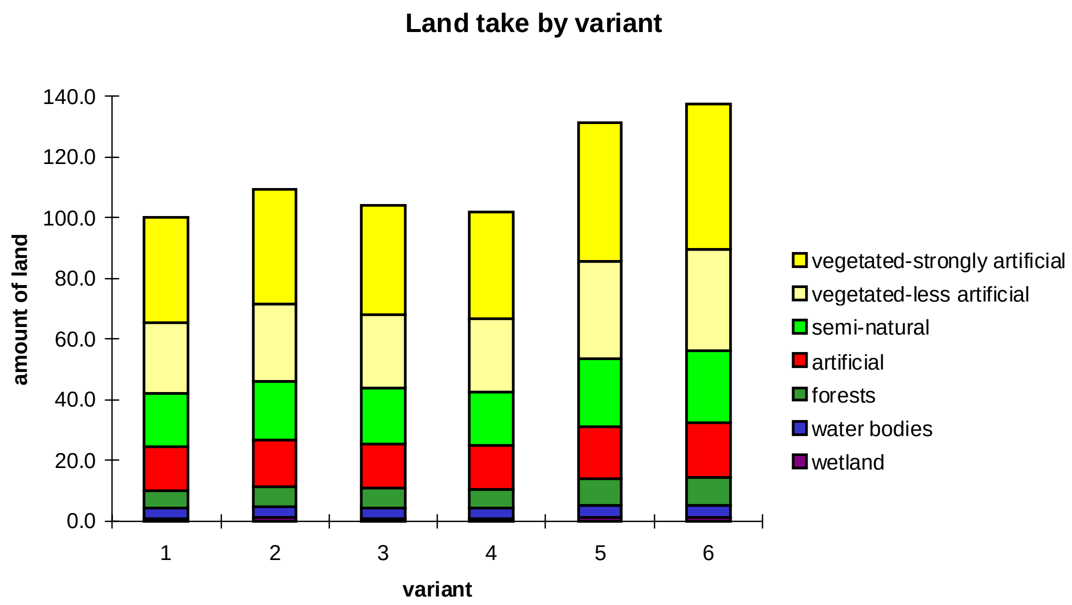
There are few concrete (quantified) targets for this indicator. One of the objectives of the CTP is to optimally use existing infrastructure. Some countries have land use policies and plans, which restrict additional developments in certain areas. For the Environment-Barometer for Germany, which uses the indicator 'increase per day in area covered by human settlements and traffic routes', a target was proposed of a reduction of 30 ha per day by 2020 (compared to 120 ha per day in 1997).

3. Preliminary compilation of the indicator

The proposed indicator considers only direct land take derived from the length of the transport infrastructure development, differentiated by major land cover types that underlie the existing and planned links.

EEA developed a first approach for a land take indicator for comparing land take by cover type. This indicator was applied for a demonstration study for environmental impact assessment of the TEN transport between 1997 and the planned TEN links until 2010 by mode (EEA, 1998). The surface by transport infrastructure is directly related to its construction characteristics. Because these are increasingly set to international standards, the variations between different countries and data sources are marginal. For the estimates of the area by land cover type, available datasets on planned networks were combined with the CORINE Land Cover data base.

During this SEA of TEN demonstration study, preliminary results of this indicator based on the available datasets were presented (see Figure 1).



variant : 1) existing network 1997 (8598 km² » 100);
2) existing network + 14 projects of specific interest (9408 km² » 109);
3) existing network + all planned rail projects 2010 (8964 km² » 104);
4) existing network + all planned inland waterway projects 2010; (8767 km² » 102);
5) existing network + all planned road projects 2010 (11285 km² » 131);
6) complete multi-modal TEN 2010 (12632 km² » 137).

amount of land : total land take of variant 1 is considered as 100.

Figure 1: Land take by mode (TEN variants) - preliminary results

4. Methodological notes

To get an indication of the land use efficiency of each mode, the direct land take must be put into the perspective of the related traffic capacity that the infrastructure offers. For example, taking into account the capacities of a motorway (1500 person cars units per hour per traffic lane) and of a high speed rail (15 trains per hour per direction), the capacity of a high speed rail equals that of a motorway with 2x4 lanes, but requires less land resources (3.5 ha/km instead of 12 ha/km land) (EC, 1993).

Estimates for motorways and high-speed train lines could be made using the certain assumptions about the number of lanes or tracks and their average width. However, there is a risk that the errors would be large. It would not be possible for associated transport facilities (garages, filling stations, parking places, etc.) to be taken into account. Further research and data collection is needed.

It will be difficult to show trends in this indicator: yearly data on new transport infrastructure (length, width, location) is not yet systematically available from Member States.

The potential environmental impact depends strongly on the type of land that is affected. Land cover types can be obtained from the European CORINE land cover, which is planned to be updated every 10 year (2 to 5 % of the land cover changes estimated). Data on new transport infrastructure (causing land take) should be collected from Member States.

5. References

EEA (1998), Spatial and Ecological assessment of the TENs: Demonstration of Indicators and GIS methods.

European Commission (1993), The European HST Network: Environmental Impact Assessment.

European Commission (1997), European Spatial Development Perspective. First official draft.

Indicator 7: Transport accidents

1. Purpose and policy relevance

This indicator gives the number of people injured or killed in transport accidents and is intended to illustrate the social effects and costs of transport.

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. This indicator provides information on how far these measures have had their desired effect.

2. Targets

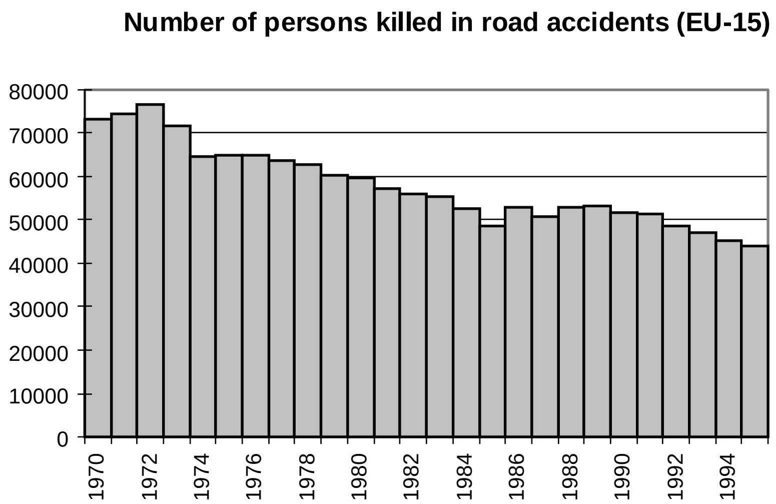
Obviously the aim of all Member States is to eliminate all traffic accidents, and to reduce the severity of those that do occur.

Some Member States have concrete traffic safety objectives, mainly for road traffic accident reductions. Sweden, for example, aims at a reduction of at least 50% of road accident fatalities by 2007 (based on 1996 levels), and a halving of accidents with private aviation during the period 1998-2007. The long-term objective for traffic safety in Sweden is that no one should be killed or seriously injured as a result of a traffic accident (Government Bill 1997/98:56).

The EU Second Community Action Programme on Road Safety (1997-2001) (COM (97) 131 final of 09.04.1997) outlines a strategy which targets a progressive reduction in the annual number of people killed in road accidents of up to 18 000 less by the year 2010 (compared to the ± 45,000 transport fatalities now).

3. Preliminary compilation of the indicator

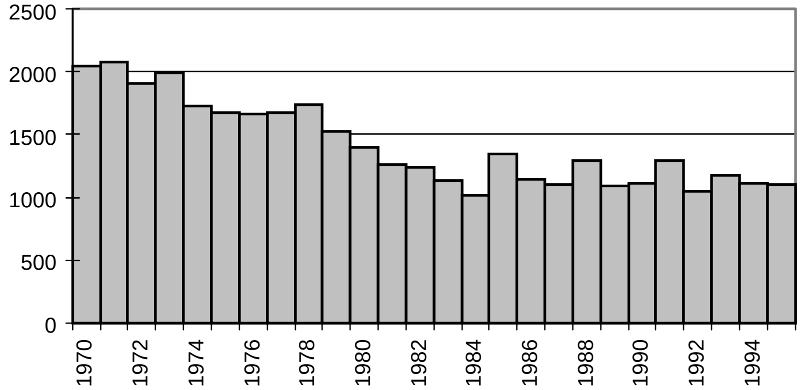
For the purposes of this preliminary compilation, data on the numbers killed in road and rail accidents are presented at EU level.



Sources: DG VII; Eurostat

Over the period 1970 to 1995 there has been a 40% decrease in deaths caused by road traffic accidents in the EU as a whole. The greatest reductions have been seen in the Netherlands, Finland and Sweden. However deaths have increased in Greece, Spain and Portugal, the countries where passenger-kilometres have been increasing most rapidly.

Number of persons killed annually in rail accidents (EU-15)



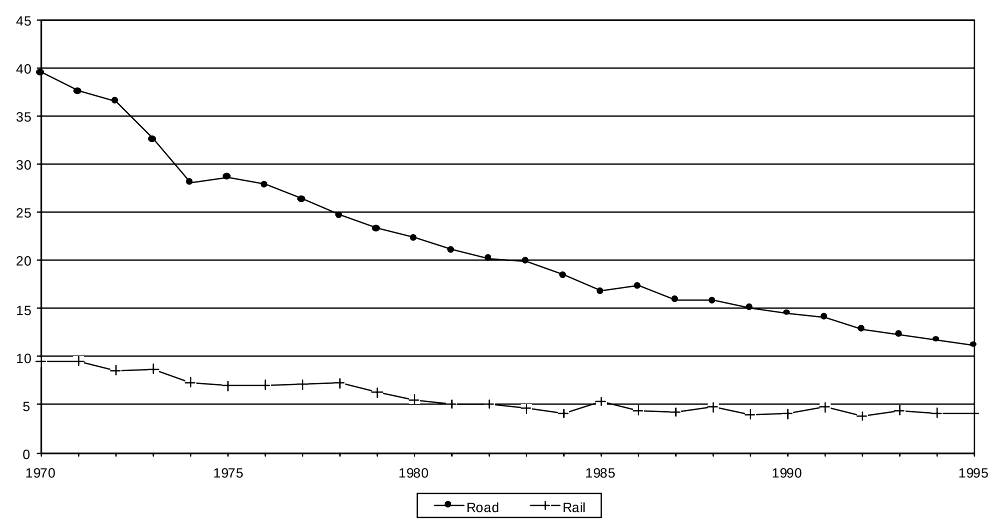
Sources: DG VII; Eurostat

Deaths caused by railway accidents are considerably fewer than those caused by road accidents, and they have also decreased at a faster rate (46% drop since 1970), partly due to a lower rate of increase in passenger-kilometres.

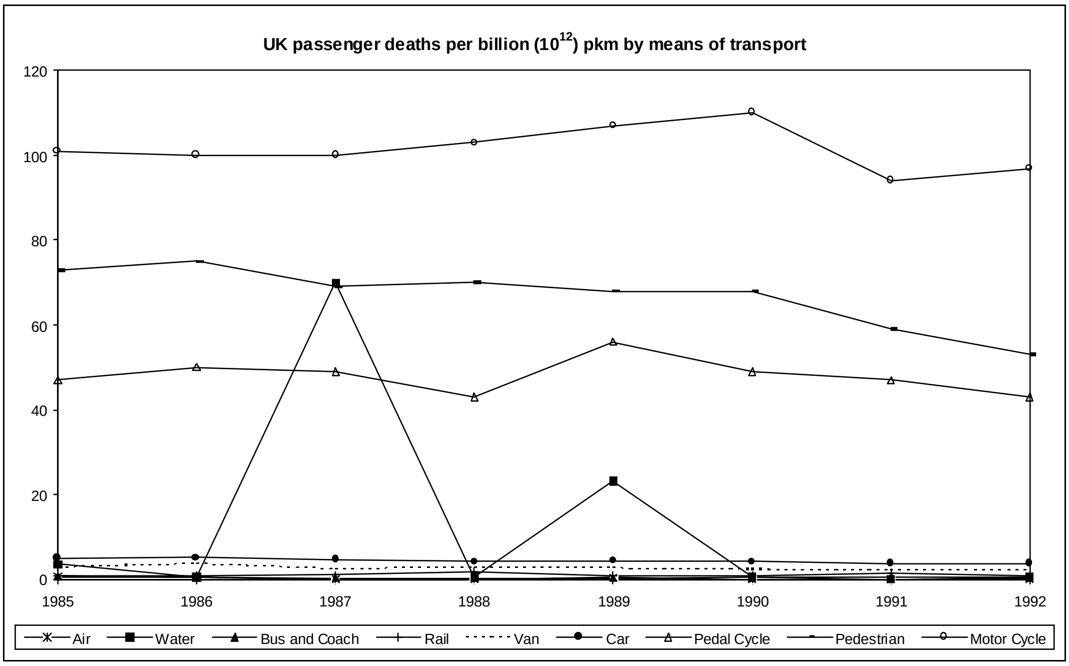
In order to make some judgements on the relative safety of road and rail transport, it is necessary to examine the death rate per passenger kilometre. Using this measure, it is clear that the dramatic difference between road and rail has been reduced, although both modes have considerably improved.

Sources: DG VII; Eurostat

Number of persons killed annually per 1000 million pkm in road and rail accidents (EU-15)



It is also interesting to look at some more detailed figures from one particular country. The next figure shows UK data comparing the number of deaths per billion (10^{12}) passenger-kilometres by means of transport for the years 1985 to 1992. These figures suggest that it is more dangerous to take a walk than to use any other means of transport with the exception of motorcycles. The safest mode of transport appears to be air (although it should be noted that the incident involving Pan Am Flight 101, in which 270 people died over the Scottish town of Lockerbie in 1988, has not been included. The reason for its exclusion is that acts of terrorism and suspected acts of terrorism are excluded. The British Midland Boeing 737 air crash on the embankment of the M1 Motorway in which 55 people died in 1989 has been included.). The peak in 1987 in the 'water' figures represents the loss of life when the Herald of Free Enterprise ferry capsized off Zeebrugge and the 1989 figure reflects the loss of life as a result of the Marchioness / Bowbelle collision on the River Thames.



Source: DG VII, UK Department of Transport

4. Methodological notes

In the long run, the intention of this indicator is to provide data on deaths and injuries caused by all modes of transport and for all Member States, to provide this information per passenger-kilometre, and to provide information on pollutant accidents.

The data provided here for road accidents in the EU represent all recorded deaths of drivers, passengers, cyclists and pedestrians, involving accidents with roads vehicles. It should be noted that there are considerable differences in national definitions of a death resulting from a road accident, ranging from death at the scene or immediately following transport from the scene (Portugal), within 3 days (Greece, Austria until 1991), within 6 days (France), within 7 days (Italy), etc. These differences make international comparisons difficult. Nevertheless, conclusions regarding trends within individual countries can be made. The passenger-kilometre data refer to passenger cars, buses and motorcycles.

The data provided for rail accidents in the EU represent passengers, railway employees and others.

The detailed data for the UK were taken from a study for DGVII entitled *Safety - Making a virtue out of a necessity* by Peter Wild (G.P. Wild (International) Limited). The figures in this study show some differences to those provided to Eurostat.

Further development of this indicator requires a more detailed analysis of individual means of transport along the lines of the UK data shown above. Account also needs to be taken of the causes of accidents, and to relate victims to the means of transport causing the fatal accident. For example, in the EU data, pedestrians killed by road vehicles are included under deaths caused by road transport: in the UK data the cause of the fatal injury to pedestrians is not clear. This type of analysis would require detailed data and harmonised definitions.

Indicator 10: Passenger-kilometres per capita and per GDP

1. Purpose and policy relevance

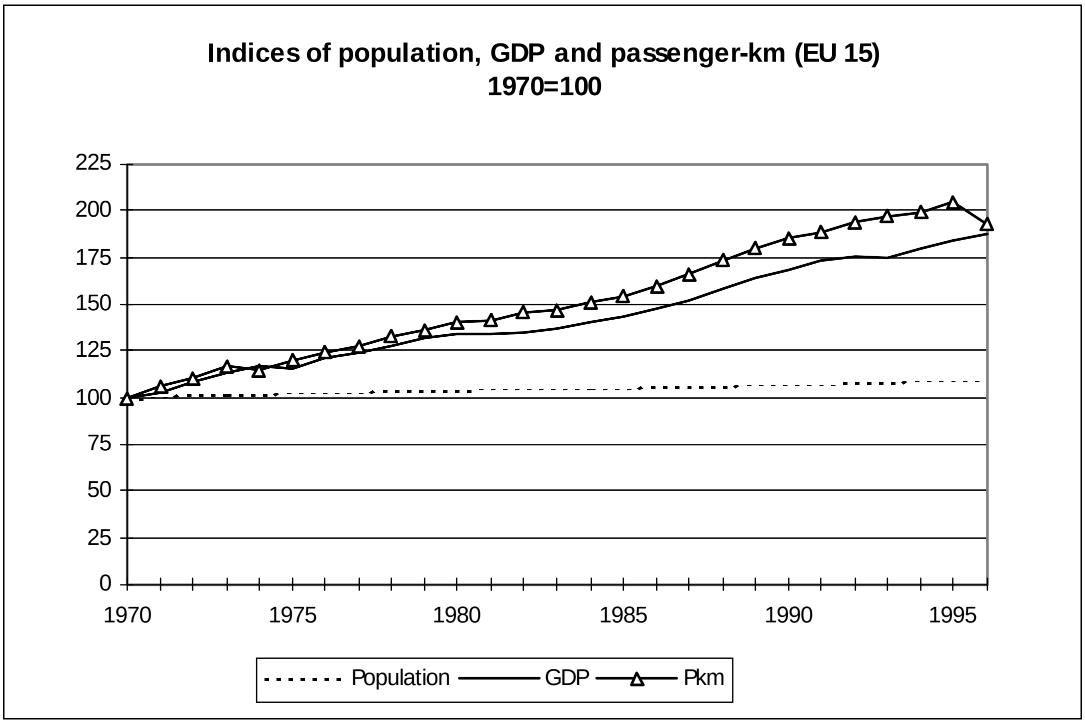
The average distance travelled in a year by each person is a measure of the transport-intensity of a society. However, the environmental pressures and impacts (e.g. energy consumption, atmospheric pollution, climate change, noise, etc.) vary according to the means of transport used.

2. Targets

Only a limited number of countries have concrete targets for this indicator. Most targets relate to modal split. E.g. some countries (such as Sweden) have targets for increasing public transport share, in the UK, the government's target is to double cycling by 2002 (compared to 1996), and double again by 2012 (National Cycling Strategy). The Commission Communication on the future perspectives of the CTP (period 2000-2004) states that *'the Commission will give particular attention to measures designed to reduce the dependence of economic growth on increases in transport activity…'*

3. Preliminary compilation of the indicator

Over the years 1970 to 1995, the population of the territory now constituting the European Union grew on average by 0.4% per year. GDP (at 1990 constant prices) grew at an average rate of 2.5% per year. During the same 25-year period, passenger-kilometres grew by 2.9% per year, and are now more than twice the 1970 level. Since 1990 there are signs that this growth rate has been slowing down and is now similar to that of GDP.

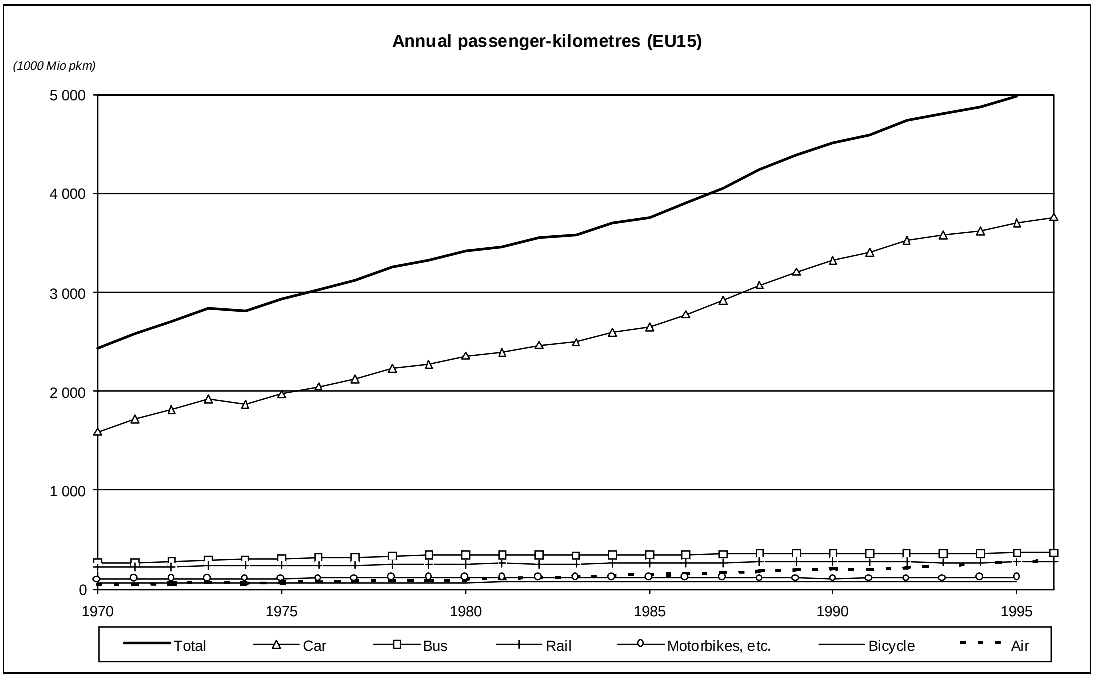


Source: DG VII; Eurostat

Road transport is the mode most used. This mode is dominated by the passenger car, which showed a 3.4% average annual growth rate between 1970 and 1995. Over this period its share rose from 65 to 74%. Buses, motorbikes and bicycles are of much less importance. Nevertheless, buses and coaches are still the second most important means of transport, having a 7% share in 1995, down from 11% in 1970. The share of motorbikes and other powered two-wheelers has fallen, as has that of bicycles. Rail, which comprised 9% of total passenger-kilometres in 1970, now stands at 5%. This is roughly equivalent to air, which has been growing at an average 7.7% per year compared with 0.9% for rail, and is the only other means which has increased its share apart from passenger cars.

Share of each means of transport in total passenger-kilometres (%)

	Car	Bus	Rail	Walking	Motorbike	Bicycle	Air	Water
1970	65	11	9	6	4	2	2	1
1995	74	7	5	3	2	1	5	1

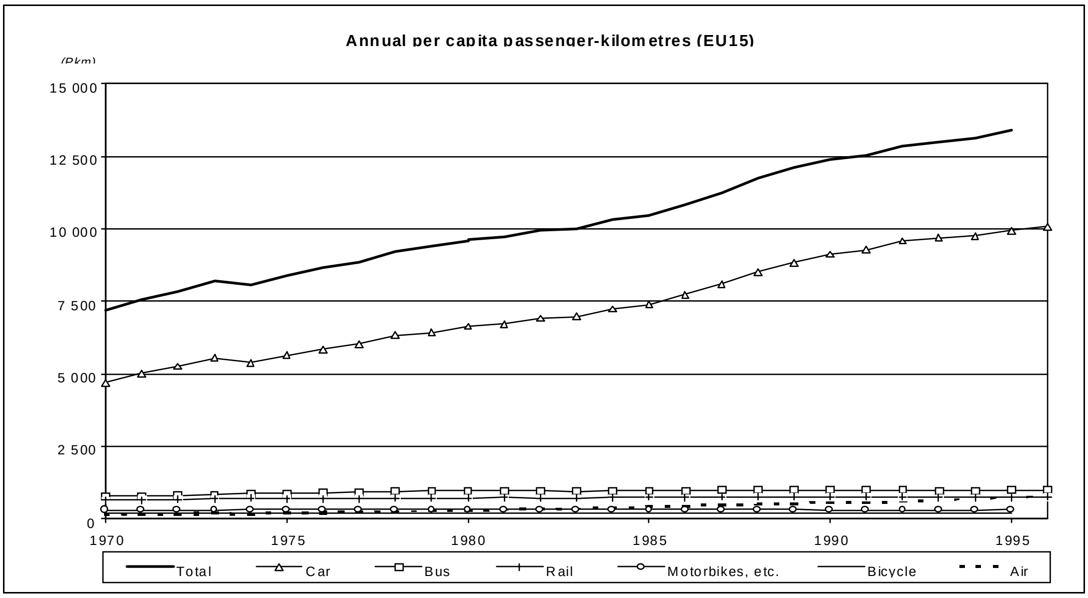


Source: DG VII; Eurostat

In 1970, the average distance travelled by each person was 7 170 km; by 1995 it had risen to 13 390 km, representing an annual average growth rate of 2.5%. The major part of this has been due to an increase in passenger car use (3.1% per year), but the fastest growth has been in air transport (7.3% per year). Walking is not shown in the figure below, but remains important. Waterborne transport, although important in some regions, is also not shown because of the low volumes at EU level.

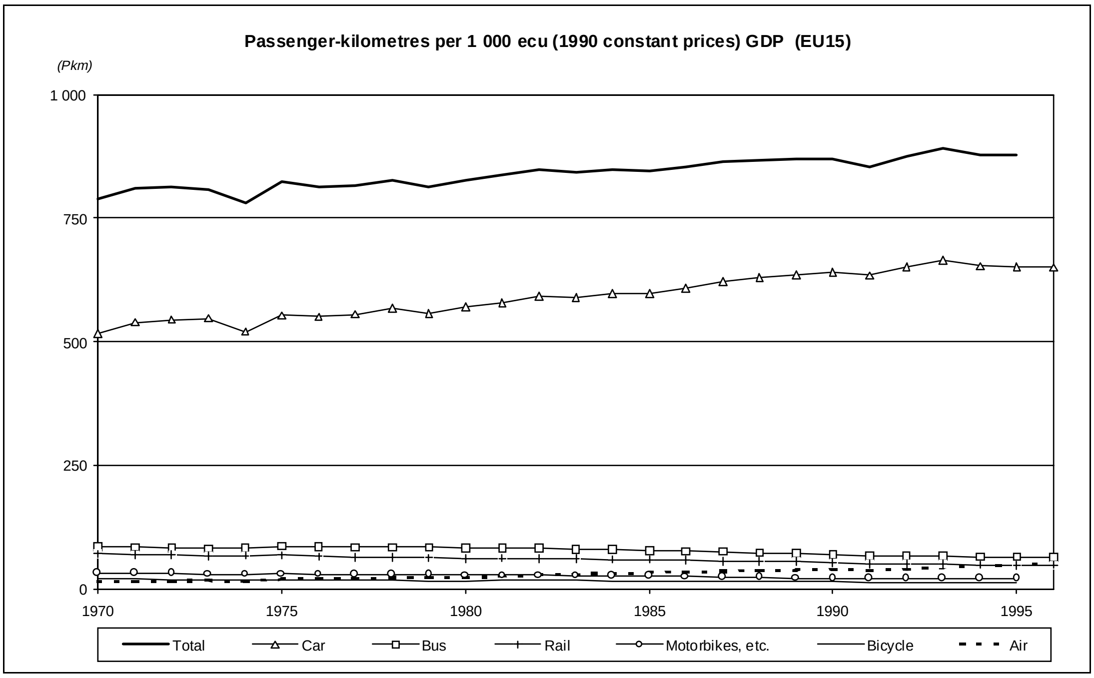
Average distances travelled per person per year by means of transport (km)

	Car	Bus	Rail	Walking	Motorbike	Bicycle	Air	Water
1970	4 680	769	637	455	284	178	126	38
1995	9 940	983	727	437	301	188	736	73



Source: DG VII; Eurostat

Over the last 25 years, passenger-kilometres per unit of GDP have grown modestly at the rate of 0.4% per year on average due to an annual growth rate of 0.9% for cars and 5.1% for air. An average annual growth rate of 0.5% for waterborne transport has had little impact due to the low volumes. Bus, rail, motorbikes and bicycles each fell by more than 1% per year on average. There is a strong correlation between GDP and passenger car ownership. Given that a person has invested in a car, paid the appropriate taxes, insurance and maintenance costs, the marginal cost per journey is rather low. As wealth increases there is also an increase in travel. But increasing wealth is also associated with an increasing value of time and personal freedom, which tends to shift passengers from the slower, cheaper means of transport towards the faster, more expensive ones.



Source: DG VII; Eurostat

4. Methodological notes

It was originally proposed to compile the passenger-km indicator (per GDP and per capita) by mode and travel purpose. However, at present it is not possible to include the travel purpose. In several Member States regular travel surveys are carried out which collect information about the purpose of trips. An attempt will be made to include this information at a later date.

Passenger-kilometres are difficult to quantify very precisely except for railway and bus transport. The figures used here have been compiled by DG VII (version of 15 September 1998) using data from Eurostat, the European Conference of Ministers of Transport (ECMT), the International Union of Public Transport (UITP), and other sources. Further work is needed within the European Statistical System to develop reliable and comparable statistics on passenger-kilometres. The results shown here should be taken as a preliminary indication of the trends at EU level which will need to be improved over time.

Definitions differ between countries and modes. For road transport, the figures, in principal, represent national traffic by vehicles registered in the reporting country, and therefore exclude international road traffic. Nevertheless, it is quite likely that at least a part of this traffic is included. Rail includes national and international traffic on national networks. Air includes national and international transport within the European Union. Waterborne transport includes international journeys within the EU, as well as coastal and inland transport, but figures on passenger-kilometres have largely been estimated due to a lack of published information. Data on bicycles were obtained by traffic counts and household surveys. Data on walking combine official statistics with the use of a model.

National and regional differences in travel patterns reflect differing economic conditions, provision and quality of infrastructure, availability of public transport as well as tax structures. It is not possible to provide an analysis of these factors at present.

GDP is at constant 1990 prices.

Indicator 11: Tonne-kilometres per capita and per GDP

1. Purpose and policy relevance

The tonne-kilometre represents the transport of one tonne over a distance of one kilometre.

- Per capita tonne-kilometres represent the freight-intensity of a society;
- Tonne-kilometres per unit of GDP is a measure of the freight intensity of an economy: how much freight transport is required to produce one unit of GDP. This indicator reflects on the one hand, the dependence of an economy on trade in raw materials and heavy goods production, and on the other, the development of other less transport-intensive industries such as trade in lighter consumer products and services.

2. Targets

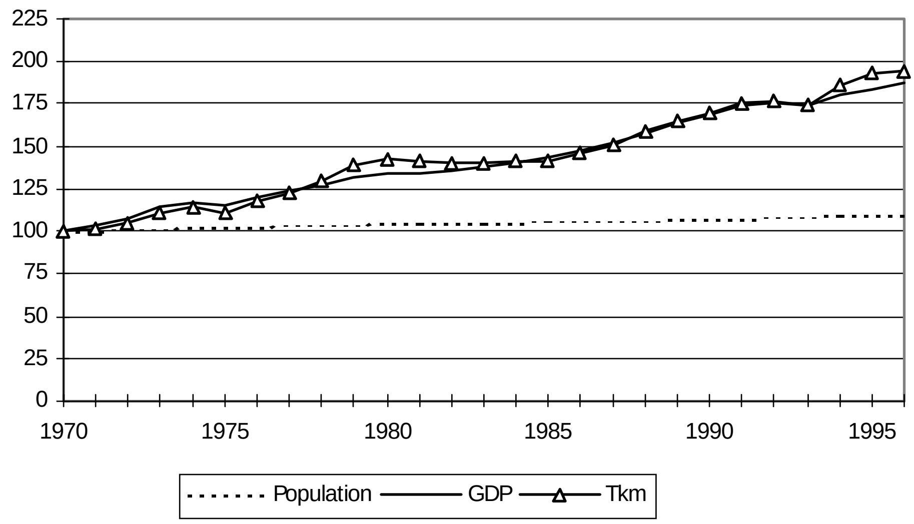
Only a limited number of countries have concrete targets for this indicator, and these mostly relate to modal split. The Commission Communication on the future perspectives of the CTP (period 2000-2004) states that *'the Commission will give particular attention to measures designed to reduce the dependence of economic growth on increases in transport activity…'*

3. Preliminary compilation of the indicator

Since 1970, freight tonne-kilometres in the territory now constituting the European Union have grown at an average rate of 2.7% per year, substantially above the growth rate of the population (0.4%). However, there have been considerable variations in the growth rate of freight tonne-kilometres over this period.

The growth in inland freight transport, as measured in tonne-kilometres, has closely followed that of GDP (average annual rate of 2.5%). The main growth in freight tonne-kilometres has been in the transport of wood, paper pulp, chemicals, manufactured products such as glass and ceramics, and machinery, although the EU economy has become less dependent on the transport of some heavy goods, such as coal and coke, and fertilizers. Increasing intra-EU trade and internationalisation has led to an increase in the share of international freight tonne-kilometres from 44% in 1970 to 53% in 1995, mainly by means of sea and road transport. Although tonnes transported have increased moderately, the major growth has been in the distances goods are carried.

Indices of population, GDP and tonne-km (EU 15)
1970=100



Sources: DG VII; Eurostat

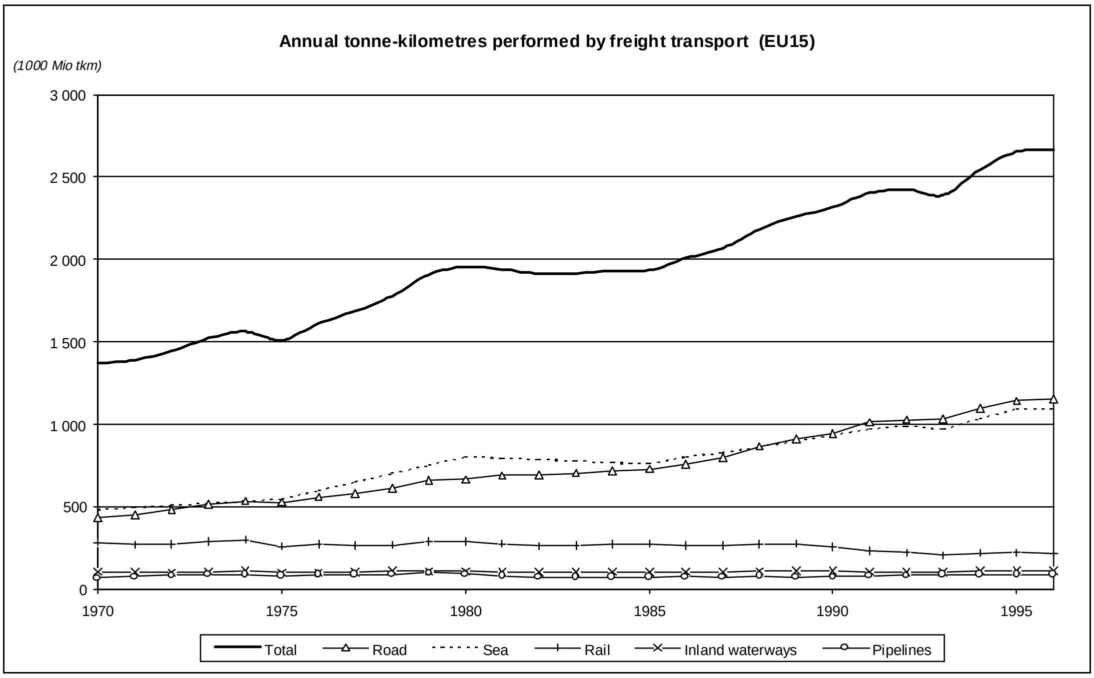
The major growth has been in road transport (3.9% per year), but this has been closely followed by short-sea shipping (3.3%). There are many reasons for the strong growth in road transport, but most notable are its speed and flexibility which are requirements of just-in-time deliveries and also reflects the tendency for factories and shopping centres to be located away from the centres of towns. Even when another mode is used, road transport is often needed for the initial and final stages of the journey to and from the place of loading or unloading. Financing of transport infrastructure has also heavily favoured roads over rail and inland waterways. This has led to road transport becoming even more dominant (43% of tonne-kilometres in 1995, as opposed to 32% in 1970). As mentioned above, short sea shipping has also shown strong growth. The only exception has been in the period 1980 to 1985, when short sea shipping showed a temporary decline. Rail transport has been declining at an average annual rate of 1% per year. Up until 1989 rail transport showed a general stagnation. From 1989 to 1993, this stagnation was further exacerbated by a very rapid decline in rail transport in Eastern Germany. Since 1994, there are signs of an expansion. Inland waterways and pipelines have shown very little growth.

Percentage shares between freight transport modes in 1970 and 1995

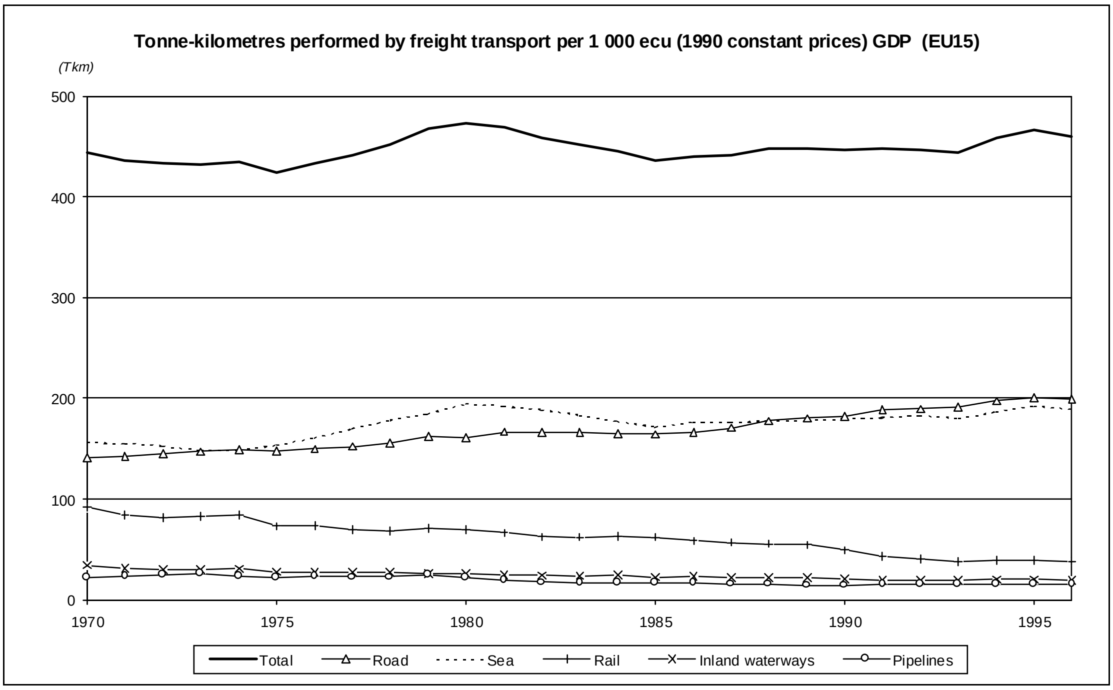
	Road	Short sea shipping	Rail	Inland waterways	Pipelines
1970	32	35	21	8	5
1995	43	41	8	4	3

Sources: DG VII; Eurostat

Sources: DG VII; Eurostat



Tonne-kilometres of inland transport per unit GDP have risen at the average rate of 0.2% per year between 1970 to 1995, although with a certain amount of fluctuation. Over this period the dominance of road transport (1.4% average growth rate per year) and short sea shipping (0.8% average annual growth) have increased, whilst the other modes have all decreased.



Sources: DG VII, Eurostat

4. Methodological notes

The figures used here have been compiled by DG VII (version of 15 September 1998) using data from Eurostat, the European Conference of Ministers of Transport (ECMT), and other sources, based on data supplied by the Member States. They represent movements of freight within the territory of the European Union as currently constituted. They have been used here to illustrate this indicator because they comprise a consistent set of data for the major modes of goods transport for all EU Member States over a significant period of time.

Indicator 14: Transport prices

1. Purpose and policy relevance

Prices play an important role as a signal for consumers and are an important determinant of consumer behaviour. Personal expenditure on transport compared to other basic needs such as food or housing is reflected in mobility patterns and lifestyle. Prices are a prime leverage point for policy measures, such as taxes and price regulation.

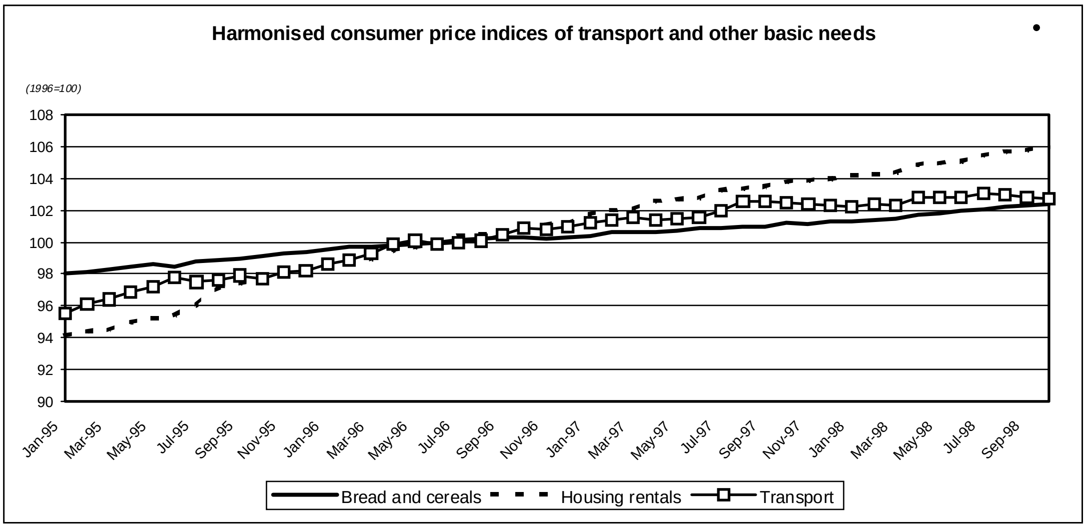
2. Targets

One of the main policy objectives of the Common Transport Policy is to achieve a 'fair and efficient' pricing system. There are no specific (quantified) targets for this indicator.

3. Preliminary compilation of the indicator

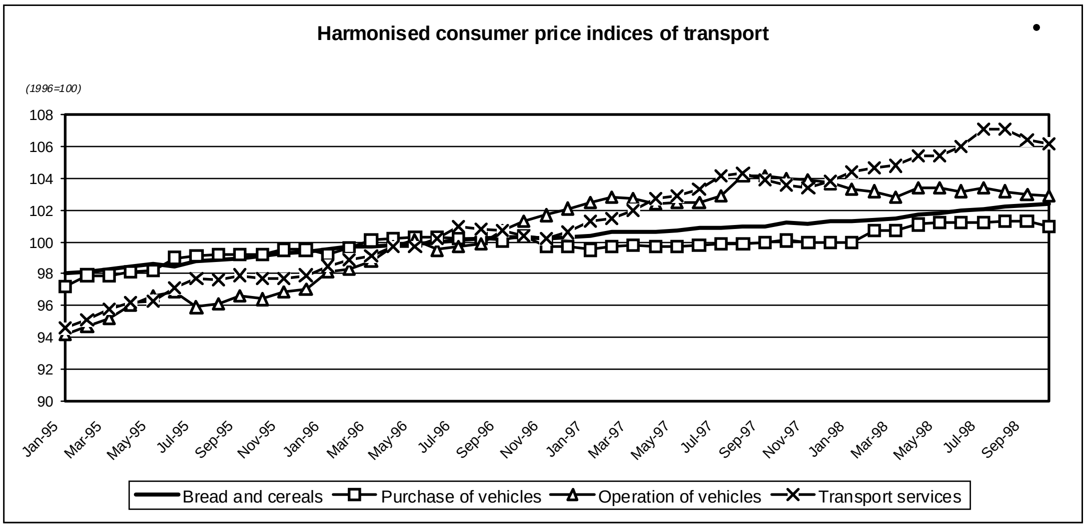
Prices can be compared between different products or services at one point in time, or for a particular place or country at different times. The first type requires the calculation of purchasing power parities (PPPs). The second type requires the calculation of consumer price indices (CPIs).

In this compilation, Eurostat's harmonised indices of consumer prices have been used. These data are unable to show actual prices, but do provide a measure of how prices are changing (consumer price inflation) across the EU.



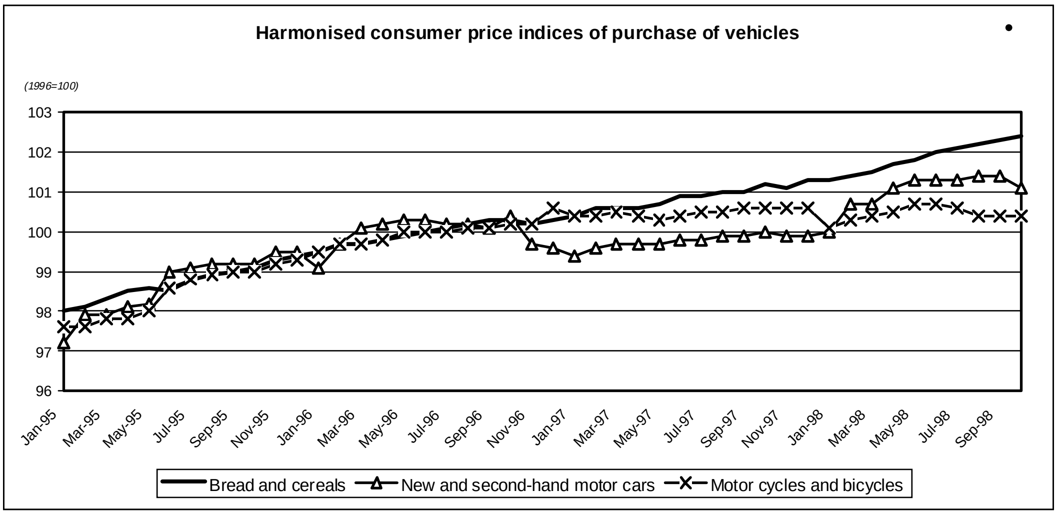
Source: Eurostat

Since January 1995, transport prices as a whole have been growing at a faster rate than bread and cereals, but not as fast as housing rentals. The growth in transport prices as a whole is therefore of the same order as other basic needs.



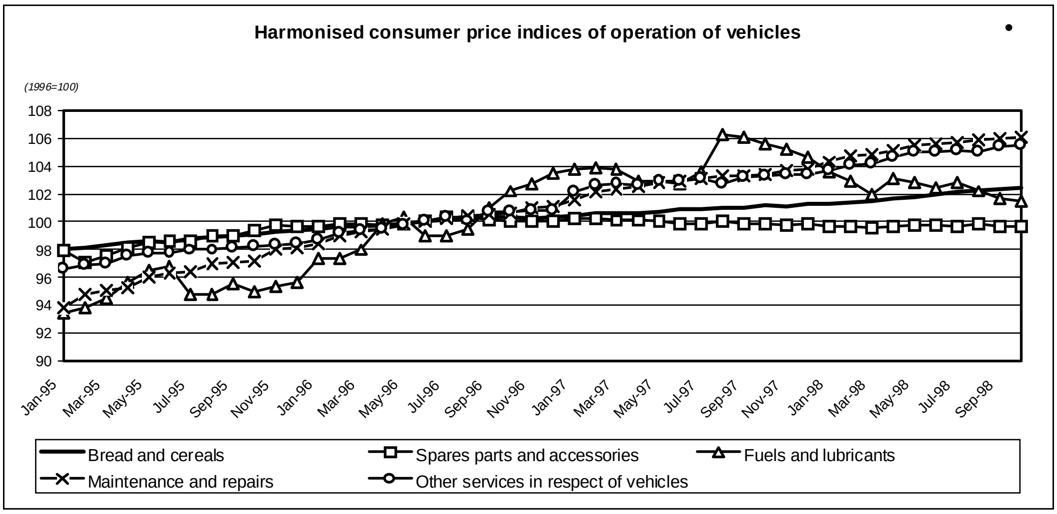
Source: Eurostat

However, the prices of transport services have been increasing more rapidly than vehicle prices and, to a lesser extent, vehicle running costs. The underlying message is that the price of public transport is rising faster than ownership and use of private vehicles, encouraging a shift away from public transport towards private cars and motorcycles.



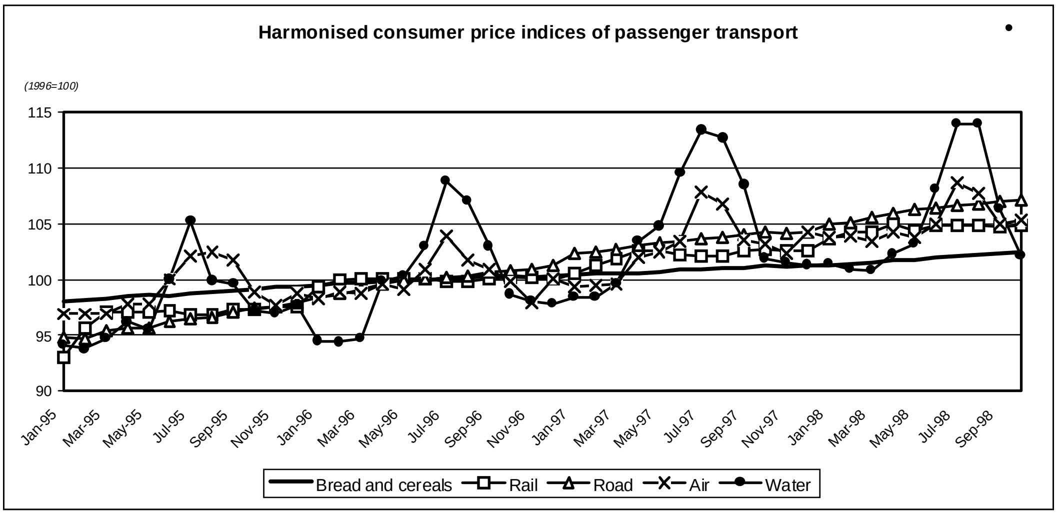
Source: Eurostat

This trend would be further reinforced by the stability of vehicle prices, which would stimulate increased vehicle ownership.



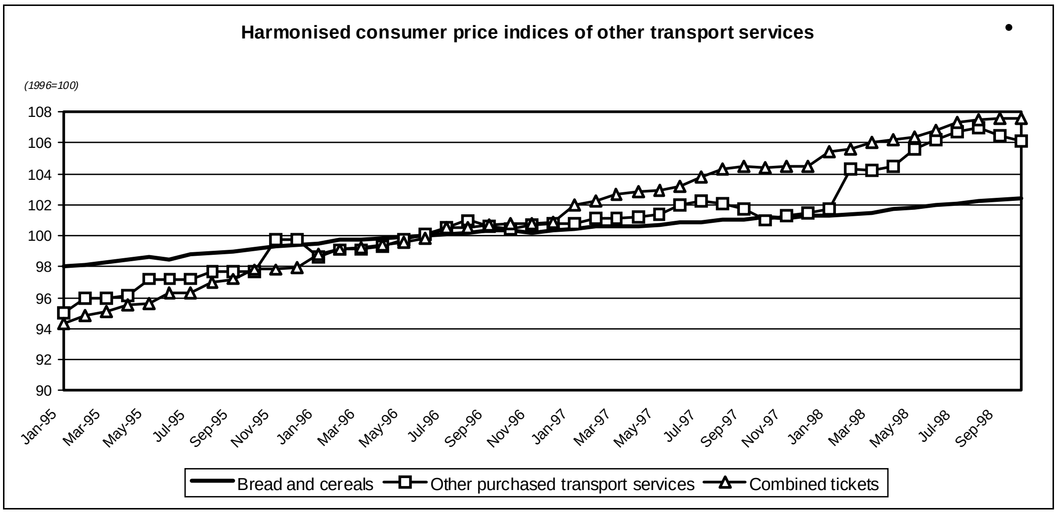
Source: Eurostat

The use of private vehicles would be further influenced by the relative stability of fuel prices, although other running costs, such as spare parts and repairs have shown much more growth.

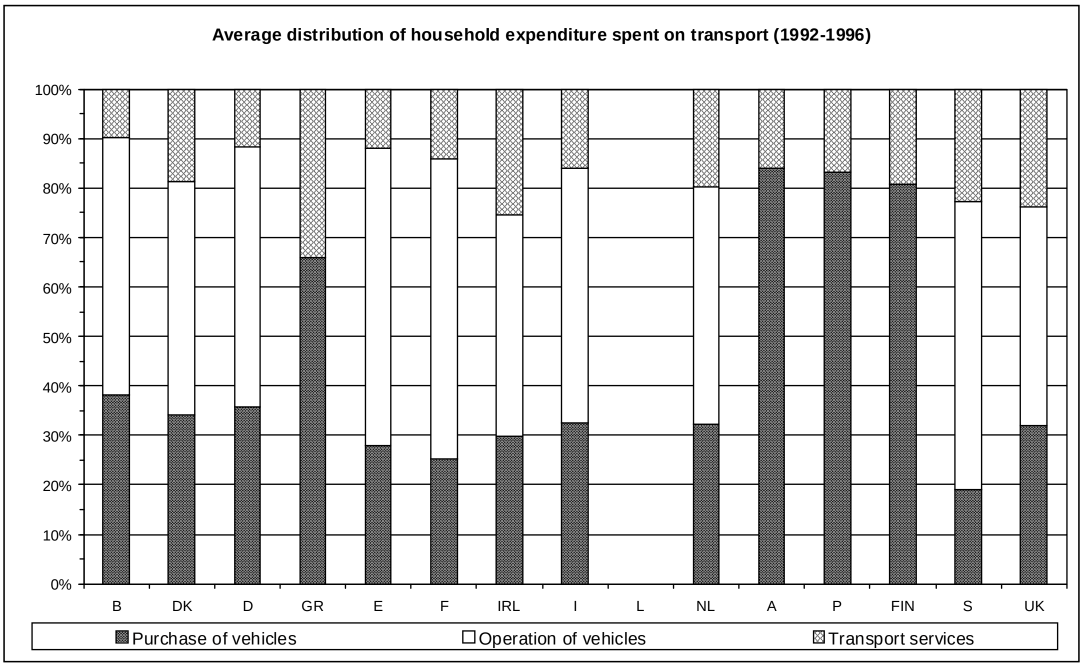


Source: Eurostat

Water and air transport both show a strong seasonal variation, having the highest prices during the summer, but have only shown moderate annual average price increases. These modes have therefore become relatively attractive. Public transport by rail and road on the other hand has become substantially more expensive. Since buses and trains are the main competitors of private cars, this can only further stimulate the growth in car ownership and use.



Source: Eurostat



Source: Eurostat

The above figure shows the average distribution of household expenditure spent on transport over the years 1992 to 1996, although it should be noted that the picture is not complete for four countries (Greece, Austria, Portugal and Finland). This expenditure represents between about 10 (Italy) and 15% (UK) of total household spending. It is clear that the major part of this expenditure is spent on purchase and use of private vehicles. Although the reasons for this are complex and depend to a large extent on the availability of suitable public transport, price signals are also an important determinant.

4. Methodological notes

The indicator originally proposed was ‘Trends in real passenger transport price’. The intention was to show how ‘real’ prices for different transport services and products vary over time and between countries. In practice it is only possible to show differences either over time or between products and services, independently but not simultaneously.

CPIs measure the change over time of a specific basket of goods and services, usually relating to the average consumer in the country concerned. They are often used as a country's main indicator of inflation. The problem in compiling CPIs at EU level is that each country compiles its CPI in different ways, so that the resulting indices are not directly comparable and a single CPI for the European Union as a whole cannot be calculated. The Eurostat harmonised indices of consumer prices presented above represent the best statistical basis for international comparisons within the European Union. These indices can provide important but partial information on the price signals being received by consumers. They are unable to show differences in 'real' prices between countries or differences in price level between different products or services.

It is intended in future to complement these data with PPPs. PPPs are a reference unit for which the ratios between the different national currencies are proportional to the purchasing power parities between those currencies. It is an indication of the amount of a national currency required to buy the same basket of goods and services in each country. It therefore provides an indication of the price of a particular product or service relative to other goods in each country at a single point in time.

Indicator 15: Fuel price

1. Purpose and policy relevance

The remarks concerning the previous indicator are also relevant here: consumers are influenced by prices and the largest part of those prices are VAT and excise duty. Fuel prices comprise the major part of the regular running costs of private cars and are therefore an important factor in the balance between private car use and public transport.

2. Targets

There are no specific targets for this indicator.

3. Preliminary compilation of the indicator

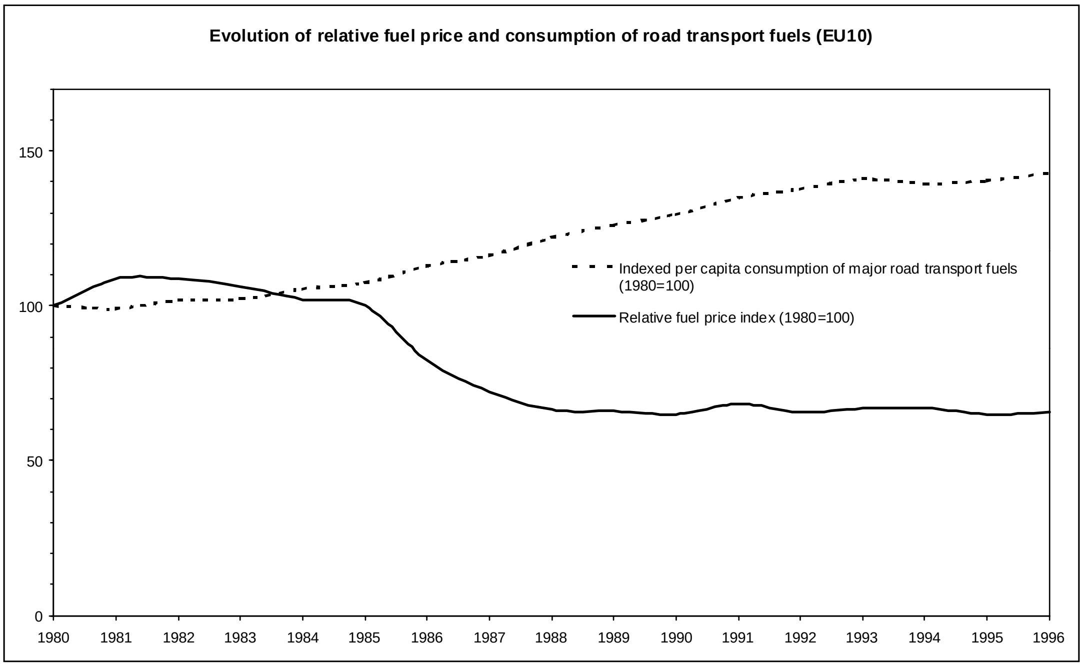
The sales prices of the three major road transport fuels (DERV, leaded petrol and unleaded petrol) vary within any particular country and across the European Union. The following table shows representative prices for each Member State, in euros and purchasing power parities (which provides an indication of the price relative to other goods). The variations between countries become even more pronounced when measured in purchasing power parities.

Sales price per 1000 litres of major road transport fuels (15 July 1998)

	Leaded	Unleaded	DERV	Leaded	Unleaded	DERV
	EUR			Purchasing Power Parities		
Belgium	946.330	870.132	592.378	976.745	898.098	611.417
Denmark	:	835.240	622.440	:	674.284	502.492
Germany	:	820.949	587.876	:	742.060	531.384
Greece	708.928	663.632	459.648	888.492	831.723	576.072
Spain	704.162	674.407	523.778	851.599	815.615	633.447
France	950.859	910.043	630.379	904.250	865.435	599.479
Ireland	878.337	747.033	699.865	1013.237	861.766	807.354
Italy	954.210	902.700	697.170	1066.470	1008.900	779.190
Luxembourg	710.362	629.248	501.432	673.081	596.224	475.116
Netherlands	:	962.016	641.943	:	954.076	636.645
Austria	:	803.135	624.500	:	757.308	588.866
Portugal	831.600	801.900	554.400	1239.840	1195.560	826.560
Finland	:	948.694	625.238	:	866.075	570.788
Sweden	:	937.573	722.000	:	755.665	581.917
United Kingdom	1083.786	988.528	1002.008	1026.383	936.170	948.936

NB: Leaded petrol is no longer sold in Denmark, Germany, Netherlands, Austria, Finland and Sweden.

In order to provide a simplified view of fuel prices, Eurostat has developed a single indicator of road transport fuel price, the relative fuel price index. This indicator shows the weighted average fuel price in comparison to per capita net disposable income.



Source: Eurostat

In the above figure it can be seen that as the price of fuel relative to disposable income rose in the early 1980s, there was a stabilisation in consumption. As the relative fuel price fell and then levelled out, consumption increased.

4. Methodological notes

Weekly data on representative road fuel prices in the Member States are collected by the Commission of the European Communities (DG XVII).

Relative fuel price is obtained by dividing the consumption-weighted average price level by per capita net disposable income. This value represents the fuel price relative to per capita net disposable income. The unit is the percentage of per capita net disposable income required to buy 1 000 litres of a mix of fuel weighted according to consumption over a six-month period.

Indicator 19: Proportion of infrastructure and environmental costs covered by transport price

1. Purpose and policy relevance

Transport services are inherently linked to costs. Costs are expressed partly in prices paid by the user, like fuel prices or ticket prices, and these prices (Indicator 14, 15) adjusted for inflation and incomes, help determine consumer behaviour. However, some costs of transport, like the external costs caused by accidents (e.g. medical treatment costs) or of the environmental impacts are not or only partly paid by the users. These external costs are paid by others regardless of their use of transport.

The Common Transport Policy aims at enhancing fair competition within and between transport modes by establishing a better alignment of charges with transport costs at the level of the individual transport user. The Green Paper 'Towards fair and efficient pricing in transport policy - options for internalising the external costs of transport in the EU (1997)' launched a broad debate on the approach to charging for infrastructure and external costs. However, differences in opinion and practice remain. In the light to the reactions to its White Paper on Fair Payment for Infrastructure Use, the Commission intends to undertake steps to launch a first phase of the programme to apply progressively the price of charging for marginal social costs.

2. Targets

No concrete targets are available. The EU objective is to achieve a 'fair and efficient' pricing system.

3. Preliminary compilation of the indicator

The present working material has been drawn from the transport chapter of the EEA's report on the Global Assessment of the 5th EAP (which is being prepared by the Wuppertal Institute). Two main studies at the EU level have been used as the basis for the analysis. A study by IWW/INFRAS provides comparable external cost estimates for the 15 Member States based on 1991 data; estimates for infrastructure costs and revenues from the transport sector are available from ECMT, based on the IWW/INFRAS figures.

It should be noted that, while the IWW/INFRAS study is considered to be the best existing compilation of external costs across the EU, an update is being prepared and methodological refinements are under discussion.

3.1. Estimates of external costs

The categories of external costs included in the IWW/INFRAS study are: air pollution, noise; anthropogenic climate change and accidents.

ECMT distinguishes four types of transport costs to be internalised: (1) environmental externalities (2) accidents (3) congestion costs (4) infrastructure costs. Accident costs (particularly fatalities) are a significant proportion of the overall external costs of transport and the value of a statistical life (VSL) figure used has a large bearing on the overall costs. The IWW/INFRAS study applies the value used by the Swedish Road Administration (based on contingent valuation studies) for all EU Member States and adjusted for purchasing power parity.

The summation of environmental external costs and the costs of accidents for each Member State by transport mode are shown in Table 3. In Table 4, the environmental external costs are shown.

Due to absence of costs of accidents, inland shipping and aviation have a larger share in the total external environmental costs than in the sum of these costs and the costs of accidents. More than half of the environmental costs come from road passenger transport, and more than 80% is caused by total road transport, according to the analysis and given the limitations set out earlier.

Table 3: Environmental external costs of transport and costs of accidents in the EU Member States in 1991 (million EUR)

	Road Passenger Transport	Road Freight	Rail	Inland Shipping	Aviation	Total
Austria	5,622	1,043	112	8	112	6,897
Belgium	7,373	1,307	126	33	413	9,252
Denmark	2,422	1,002	120	0	243	3,787
Finland	2,510	698	94	6	170	3,478
France	22,911	12,087	335	15	1,782	37,130
Germany	52,448	9,398	1,445	351	3,060	66,702
Greece	2,241	999	29	0	164	3,433
Ireland	1,098	474	35	0	89	1,696
Italy	28,130	6,665	832	1	1,151	36,779
Luxembourg	272	68	9	1	8	358
Netherlands	5,961	1,868	139	229	2,029	10,226
Portugal	5,047	398	118	0	157	5,720
Spain	14,388	6,314	293	0	977	21,972
Sweden	4,567	960	69	1	258	5,855
UK	29,542	8,966	538	2	4,209	43,257
EU 15	184,532	52,247	4,294	647	14,822	256,542
% of total cost	72	20	2	0.3	6	100

Table 4: Environmental external costs of transport in EU Member States in 1991 (million EUR)

	Road Passenger Transport	Road Freight	Rail	Inland Shipping	Aviation	Total
Austria	1,364	568	73	8	112	2,125
Belgium	2,130	772	112	33	413	3,460
Denmark	1,259	729	109	0	243	2,340
Finland	1,106	459	71	6	170	1,812
France	7,267	6,700	191	15	1,782	15,955
Germany	16,539	5,796	1,247	351	3,060	26,993
Greece	371	349	11	0	164	895
Ireland	416	289	29	0	89	823
Italy	10,181	4,270	768	1	1,151	16,371
Luxembourg	108	44	8	1	8	169
Netherlands	2,783	1,375	113	229	2,029	6,529
Portugal	796	151	53	0	157	1,157
Spain	3,000	2,579	281	0	977	6,837
Sweden	2,181	777	46	1	258	3,263
UK	13,080	6,419	489	2	4,209	24,199
EU 15	62,581	31,277	3,601	647	14,822	112,928
% of total cost	55%	28%	3%	1%	13%	100%

3.2. Calculating the degree of internalisation

Data on revenues accrued from transport users and the public costs of providing infrastructure is available from ECMT, based on the IWW/INFRAS study, for road and rail only. It has not been possible to obtain consistent data for inland shipping or aviation. The lack of data for inland shipping may be due to the fact that no levies are imposed on inland navigation on the River Rhine, which is the predominant part of all inland navigation in the EU. The situation for aviation is complex due to exemptions from excise duties and VAT for the predominant part and diverse sources of financial support for the construction and operation of airports.

The available data on external costs, revenues and infrastructure costs has been used to calculate the degree of internalisation (or cost recovery rate) for both road and rail transport in each Member State.

An analysis shows that most Member States presently internalise less than 50% of the external costs and infrastructure costs from transport within the prices users pay for the road and rail systems. Within this, Denmark, the Netherlands and Sweden have high cost recovery rates of above 40%, while Belgium and Portugal are much lower at slightly less than 15%. Cost recovery rates are generally higher for rail (39%) than for road (30%), although Denmark, Finland, Ireland and Sweden are exceptions to this trend. Public sector policies towards rail, aimed at encouraging greater use by e.g. subsidising infrastructure, can explain these types of differences.

Table 5: Degree of internalisation of external costs in the transport sector

Member State	Road (%)	Rail (%)
Austria	25	52
Belgium	7	48
Denmark	52	31
Finland	29	12
France	34	57
Germany	26	33
Greece	19	46
Ireland	40	34
Italy	40	44
Luxembourg	24	43
Netherlands	41	46
Portugal	10	31
Spain	21	50
Sweden	48	13
United Kingdom	38	47
Average (EU15)	30	39

4. Methodological notes

Not included in the estimate of environmental external costs are water and soil pollution, pollution caused by production and disposal of vehicles, severance effects in ecosystems, visual annoyances and barrier effects in communities. This implies that the environmental costs are underestimated.

The estimates of the external costs of climate change, while methodologically consistent, are based on limited knowledge and a high degree of uncertainty. Furthermore, the climate impact of aviation from the additional contribution of NO_x and H_2O emissions of aircraft at cruising altitude are not included. The findings, therefore, significantly underestimate the external costs caused by aviation.

Data on maritime shipping is lacking in most instances owing to the open question of how to allocate maritime shipping activity to individual countries, limited statistics and relatively poor interest in the environmental impacts caused by this mode of transport.

Methodological problems in calculating external costs remain to be incompletely solved. The figures provided can only be regarded as rough estimates of the real magnitudes. This especially holds for the external costs of climate change which actually can only be estimated based on limited knowledge about the likely effects on mankind and the environment.

5. References:

EEA (1999), Monitoring Progress Towards Integration , a contribution to the Global Assessment of the Fifth EAP, Interim Report, (30 March 1999)

ECMT (1998), Efficient transport for Europe - Policies for Internalisation of External Costs. ECMT, Paris

IWW/INFRAS (1995), External effects of Transport

Indicator 23: Uptake of cleaner fuels

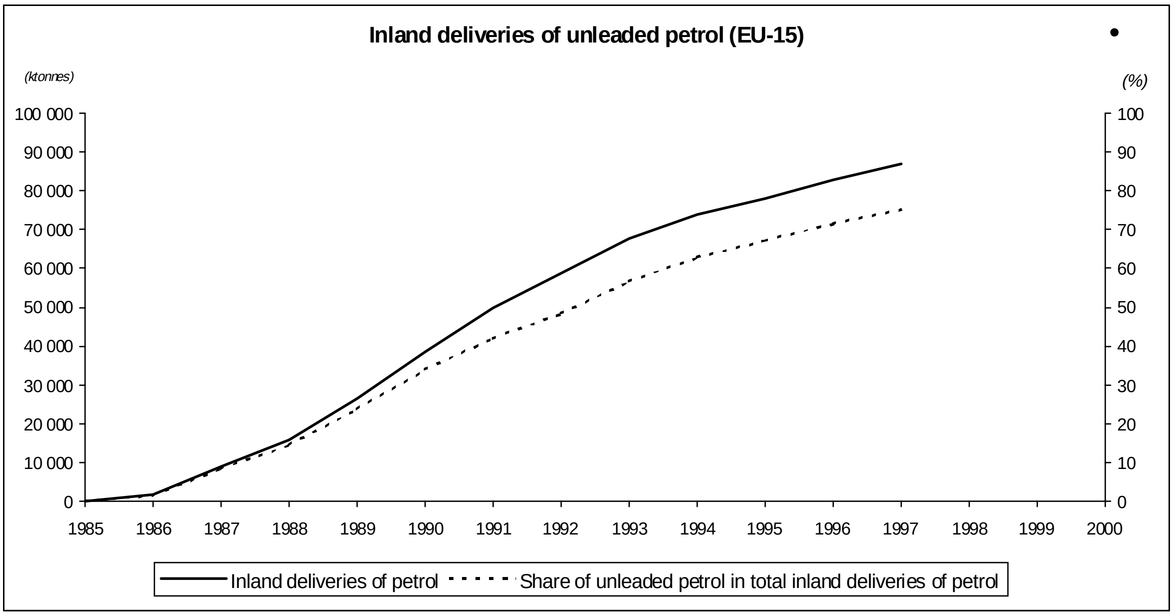
1. Purpose and policy relevance

The purpose of this indicator is to show to what extent unleaded petrol is already in use, and how far conventional fuels have been replaced with alternative transport fuels such as LPG and natural gas.

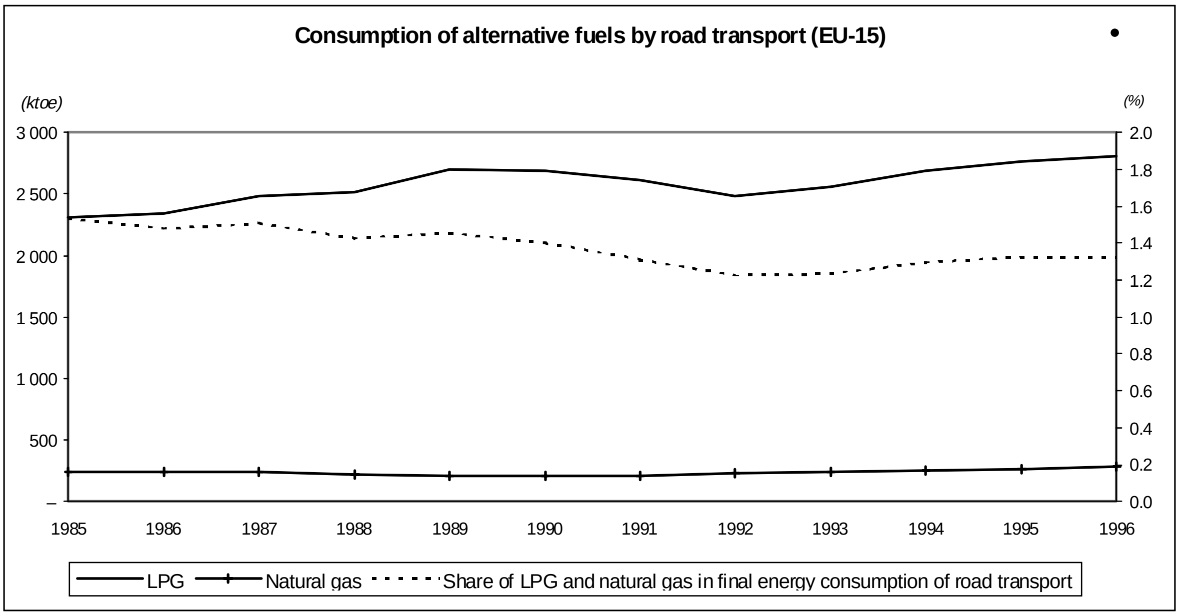
2. Targets

It is intended to eliminate leaded petrol in the EU market by the year 2000.

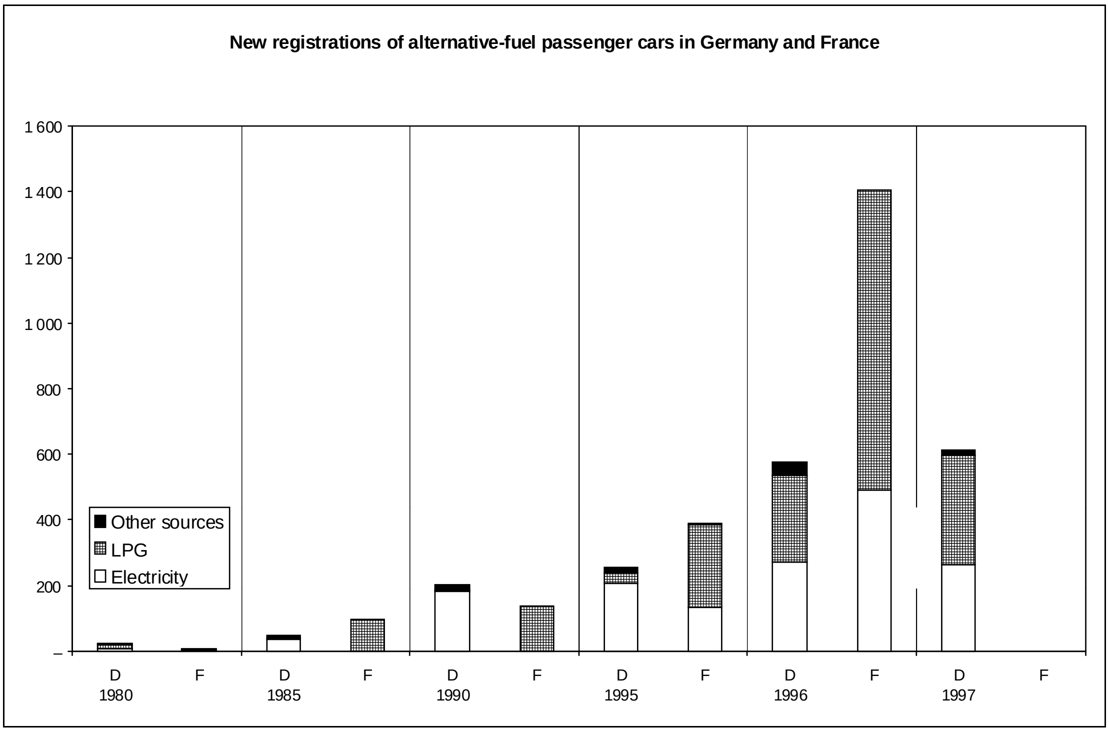
3. Preliminary compilation of the indicator



Source: Eurostat



Source: Eurostat



Source: Eurostat

4. Comments

Since its introduction in 1986, deliveries of unleaded petrol have been growing at an average rate of 43% per year. In 1997 the share of unleaded petrol in total inland deliveries of petrol stood at 75% for the EU as a whole, as opposed to 0% in 1985.

Consumption of alternative transport fuels has been growing rather slowly (at about 1.8% per year). However, the share of alternative fuels in the total fuel consumption of road transport has diminished from 1.5% in 1985 to 1.3% in 1996. New registrations of alternative-fuel vehicles (AFVs) have also been slowly increasing. Nevertheless, they still represent only a very small proportion of the total vehicle stock.

Some Member States have introduced specific measures favouring the introduction of AFVs. For example, during 1998 France introduced a law obliging public bodies with a fleet of more than 20 vehicles to acquire 20% of AFVs as vehicles are replaced. Another French law provides financial aid for the acquisition of new electric vehicles.

5. Methodological notes

Inland deliveries of motor spirit include all transport use. Small amounts are used by general aviation and inland waterways vessels, but account for less than 0.5% of the total.

Alternative transport fuels are defined here as 'a type of motor energy which provides substantial environmental benefits over conventional fuels (petrol or diesel).' They include electricity, LPG, natural gas (NGL or CNG), alcohols, mixtures of 85% by volume or more of alcohols with other fuels, hydrogen, biofuels (such as biodiesel), etc. (This list is not exhaustive.) Alternative fuels do not include unleaded petrol, reformulated petrol or city (low-sulphur) diesel. Only data on LPG and natural gas are collected by Eurostat, and countries with very low consumption do not report their figures.

Indicator 25: Average age of the vehicle fleet

1. Purpose and policy relevance

The age structure of the vehicle fleet can provide valuable information regarding the rate at which new emission, noise and safety standards are becoming incorporated in the vehicle fleet.

Road vehicles have become more fuel-efficient, less polluting, less noisy and safer over the years owing to a progressively stricter regime of standards. Due to these stricter emission standards, and also because catalytic converters deteriorate with age, the quantity of emissions produced by older vehicles is disproportionate to their number. With the aim of reducing the numbers of older vehicles, several European countries have introduced scrapping schemes.

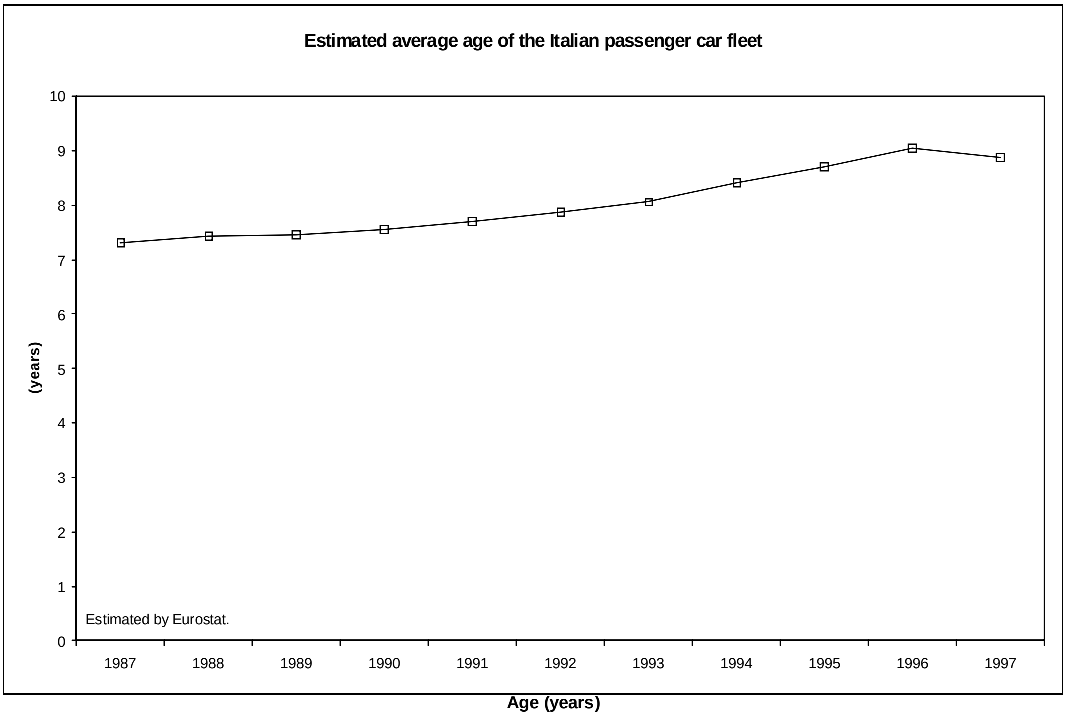
This indicator provides valuable information on potential leverage points and makes it possible to evaluate the success of scrapping schemes.

2. Targets

There are no specific targets for this indicator.

3. Preliminary compilation of the indicator

A complete time-series is no available at EU level. However, for this preliminary compilation, some illustrative data for Italy are shown.



4. Comments

It can be seen that the average age of the Italian passenger car fleet increased over the period 1987 to 1996. Italy introduced a scheme of accelerated vehicle retirement from January to September 1997, involving financial incentives to scrap vehicles provided a new model was bought as a replacement. The fall in the average age is apparent in the first figure. The second figure shows that in 1997 there was an abrupt increase in the percentage of new cars accompanied by a decrease in older ones. In 1996 there was a lower percentage of cars less than 5 years old and a higher percentage of cars over 10 years old than in 1987.

5. Methodological notes

Data on the age of different types of road vehicles are collected through the Eurostat-UNECE-ECMT common questionnaire for transport statistics. However, these data have only been collected for a few years and are not available from all EU Member States. The basic data shown here have been provided by Michele Fontana working at ECMT and were originally obtained from ACI, Rome. The average ages were estimated by Eurostat using an exponential decay function to estimate the average age of older vehicles which were not included in the original data set.

Eurostat is also calibrating vehicle lifetime functions developed by the Department of Mechanical Engineering, Aristotle University of Thessaloniki, Greece, using available statistical data in order to estimate average ages. These lifetime functions could then be used to estimate the proportion of the vehicle fleet conforming to certain environmental or safety standards.

The combining this indicator with indicator 26 (proportion of vehicle fleet meeting certain air and noise emission standards) is being investigated.

Indicator 26: Proportion of vehicle fleet meeting certain air and noise emissions standards

1. Purpose and Policy relevance

In this indicator sheet, the percentage of petrol-powered passenger cars fitted with catalytic converters is used as a preliminary illustration of the indicator.

The purpose of this indicator is to show to what extent catalytic converters are penetrating the vehicle fleet.

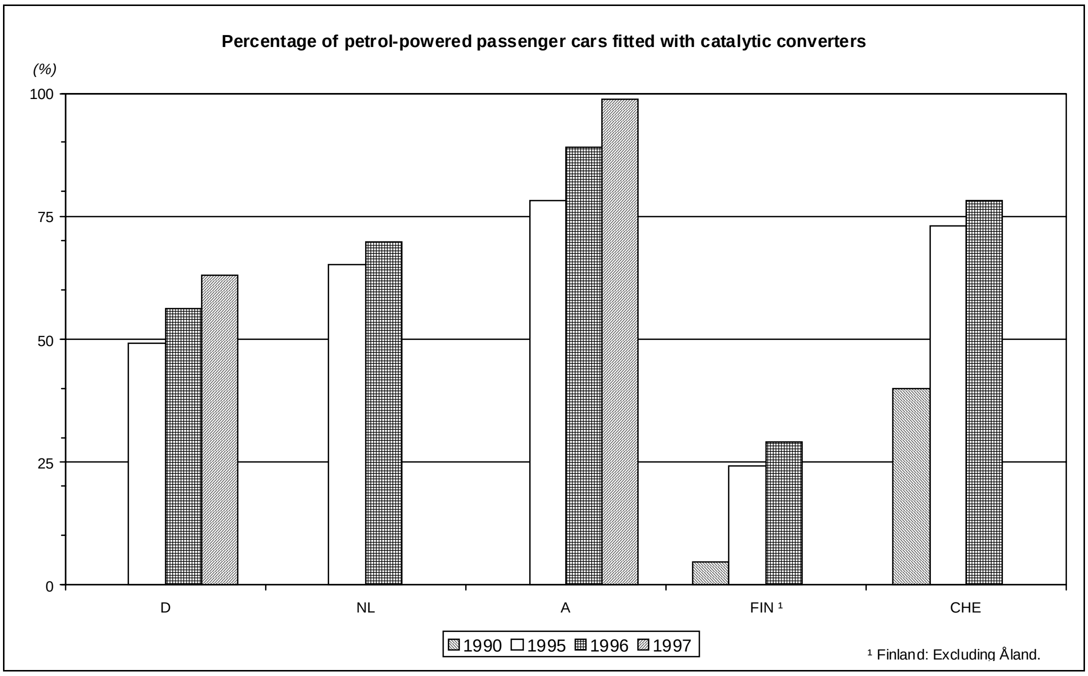
2. Targets

There are no specific targets for this indicator.

3. Preliminary compilation of the indicator

There is still some way to go before all petrol-powered passenger cars in the European Union are fitted with catalytic converters. In most EU countries, catalytic converters were only made compulsory in the early 1990s. By 1997 only Austria had nearly complete penetration.

The proportion of petrol-powered passenger cars fitted with catalytic converters is dependent on the rate at which vehicles are replaced, as well as the date on which catalytic converters were made compulsory and the incentives for fitting them before this date. This indicator is closely related to Indicator 12, the average age of the vehicle fleet.



Source: Eurostat

4. Methodological notes

Data were obtained through a survey carried out by Eurostat for UNECE on the road vehicle fleet of 55 countries. Only five of these countries were able to provide data on the numbers of passenger cars fitted with catalytic converters. It is expected that the response rate will become higher once this question is incorporated in the regular collection of transport statistics.

Furthermore, Eurostat intends to combine information on the dates at which legislation came into force with data on the age structure of the passenger car fleet (see indicator on the average age of the vehicle fleet). This approach would provide the numbers of vehicles conforming to different emission standards.