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Towards a more sustainable transport indicator

Critical assessment of the modal split as an indicator for the EU Sustainability Strategy

Report

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Summary

Current EU Sustainability Strategy transport indicators

Within the EU's Sustainability Strategy, a framework for sustainable development in Europe, indicator mechanisms have been specified to report on progress. With respect to environmental quality, six indicators have been agreed on, two of them transport-related: modal split and volume of transport relative to GDP.

The Dutch Ministry of Environment has serious doubts whether these two indicators, and particularly the modal split, are appropriate yardsticks for measuring progress towards a more sustainable transport system in Europe. The ministry therefore commissioned CE, Delft, to undertake a study to evaluate the EU's modal split indicator and propose ways of improving the monitoring of sustainable transport trends in Europe.

Discussion on the modal split

Many of the environmental impacts of transport, such as climate change, air pollution and noise, are still far in excess of EU sustainability targets and are causing serious problems in every Member State. The situation is often explained with reference to statistics on the modal split: road and air have grown faster and are on average more polluting than rail and shipping. The odd thing, however, is that this analysis does not allow the reverse conclusion: that policies aimed at 'improving' the modal split - towards relatively less road and air and more rail and shipping – lead to the desired reduction of impacts and thus to more sustainable transport.

Modal split ignores improvements in environmental performance

In the case of road vehicles, particularly, technological innovations have led to a substantial decline of environmental impact. The emission standards for new truck engines due for introduction in 2009 will be 90% lower than in 1982 for NO_x and even 95% lower than in 1993 for PM_{10}. For rail and shipping, too, standards are in force, although less restrictive and in many cases not yet consolidated in legislation. For all modes of transport it holds, though, that technological innovation is a potentially very effective instrument. The modal split indicator reflects *none* of the environmental benefits of these improvements and is consequently a poor indicator for sustainability.

In competing markets: small differences between modes

In specific market segments and for the whole transport chain from origin to destination, inter-modal differences in environmental impact can be very different from the overall average difference. Recent studies by IFEU-Heidelberg and CE-Delft show that the differences in the environmental impact of competing segments of road and rail freight are much smaller than the average differences between road and rail. Particularly in emerging markets, such as containers and swap bodies, the differences in environmental performance are small: the CO_2 emissions of rail transport are generally less than 30% lower and in some cases even higher than those of road transport. For NO_x emissions, the increasingly popular diesel train as well as shipping score similarly to or, in some cases, worse than road transport. Both studies show that inter-modal differences in environmental performance are highly

dependent on the particular situation involved. Both institutes therefore conclude that assessment is feasible only on a case-by-case basis.
With respect to noise, the EEA's TERM2001 report estimates that more than 30% of Europeans are seriously annoyed by road noise and around 10% by rail noise, even though road has a 5 to 10 times greater market share than rail. In addition, there are no noise emission standards in force for rail transport. Finally, in the case of freight transport, trains run more frequently through city centres, causing more noise nuisance than their competitors, long-distance trucks.

Potential environmental effects of modal shift are very limited

Overall, the potential environmental impact of shifting freight from road to rail is very limited. The first reason is that in competing transport markets environmental differences between modes are relatively small. The second reason is that the competing markets eligible for modal shift are limited to the transport of large quantities of goods over long distances, specifically more than several hundred kilometres[1]. If the current share of rail in European freight transport were to double from 8 tot 16% - an immense effort, given the 2010 target of stabilising the modal split presented in the Common Transport Policy for 2010 - total CO_2 emissions from European freight transport would decrease by between 1 and 2%[2]. NO_X and PM_{10} emissions and noise may increase or decrease, depending on such factors as technology, load factors and the location of the road and rail transport involved.

Improving environmental performance is more effective

We conclude that policies to 'reverse' the modal shift in favour of rail and waterway transport may have very little if any environmental impact, and may even prove negative. A more substantial reduction of these impacts can be achieved by improving the environmental performance of each individual mode.

Alternatives

In the short term, the most promising alternative to the modal split indicator seems to be the total emissions of CO_2, NO_x and PM_{10} per passenger-kilometre and tonne-kilometre, combined with the percentage of the EU population exposed to transport-related noise in excess of 55 dB. This dual indicator is related far more directly to environmental impact and would act as an incentive for *all* possible options for making transport really cleaner - including modal shift.

In the longer term, an ideal indicator would be the total external costs per passenger-km or tonne-km. With this indicator, all environmental impacts and even safety aspects could be expressed in a single figure. However, lack of a uniform method for calculating external costs and the unavailability of the required data in many Member States means that this indicator is not yet a practical feasibility.

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1 The average tonne of goods trucked travels 110 km (source: *TERM 2001*, European Environment Agency, 2001).

2 Based on information from *TERM 2001*, EEA, 2001, IFEU, 2001 and CE Delft/RIVM/TNO, 2000. The figure does NOT take into account the fact that new rail or waterway infrastructure may generate new transport with new environmental impacts.

1 Background of the current indicator set

1.1 Reason for this paper

A good reporting mechanism is a critical success factor in policy making. Policy makers and other stakeholders often tune their decisions on the potential effects on the indicators of a progress reporting mechanism.

The EU Sustainability Strategy is a framework for sustainable development in Europe. Within this framework indicator mechanisms have been specified to report on progress. With respect to environmental quality, six indicators have been agreed on, two of them transport-related: modal split and volume of transport relative to GDP.

The Dutch Ministry of Environment has serious doubts whether these two indicators, and particularly the modal split, are appropriate yardsticks for measuring progress towards a more sustainable transport system in Europe. The ministry therefore commissioned CE Delft, to undertake a study to evaluate the EU's modal split indicator and propose ways of improving the monitoring of sustainable transport trends in Europe.

1.2 Short history of the sustainability strategy of the EU

Since the 1998 Cardiff Initiative the EU has put much effort in stimulating the integration of environmental policy and other policies. In 2001, the Gothenburg summit launched the basis for a strategy for sustainable development. At the Gothenburg summit three pillars of sustainable development - economic, social and environmental - were brought together into one integrated policy framework.

1.3 The current indicator set

Within the EU sustainability framework, indicator mechanisms have been specified to report on progress. There are indicators for each of the following subjects:

- general economic background;
- employment;
- innovation and research;
- economic reform;
- social cohesion;
- environment.

For the environmental developments, there has been agreed upon six indicators:

- greenhouse gas emissions;
- share of renewables in electricity consumption;
- volume of transport vs. GDP (Gross Domestic Product);
- modal split of transport;
- urban air pollution;
- municipal waste.

Two of these indicators deal with transport: the modal split and the volume of transport vs. GDP.

1.4 Arguments for choosing the modal split indicator

Many of the environmental impacts of transport, such as climate change, air pollution and noise, are still far in excess of EU sustainability targets and are causing serious problems in every Member State. In the past, it was certainly true that this could to a large degree be explained by the rapid growth of road and air transport, being in average the most polluting transport modes.

The most important argument for choosing the modal split as one of the indicators of the EU sustainability strategy is probably the supposed potential contribution to CO_2 reduction. Other arguments can be found in the results of EU summit in Gothenburg in 2001 and in the CTP white paper 'European transport policy for 2010: time to decide'.

The presidency conclusions of Gothenburg summit in 2001 say [EC, 2001a]:

> *"A sustainable transport policy should tackle rising volumes of traffic and levels of congestion, noise and pollution and encourage the use of environment-friendly modes of transport as well as the full internalisation of social and environmental costs. Action is needed to bring about a significant decoupling of transport growth and GDP growth, in particular by a shift from road to rail, water and public passenger transport."*

The CTP White Paper 'European transport policy for 2010: time to decide' says [EC, 2001-b]:

> *"The fact that there has been no harmonious development of the common transport policy is the reason for current headaches such as:*
> - *unequal growth in the different modes of transport. While this reflects the act that some modes have adapted better to the needs of a modern economy, it is also a sign that not all external costs have been included in the price of transport and certain social and safety regulations have not been respected, notably in road transport. Consequently, road now makes up 44% of the goods transport market compared with 41% for short sea shipping, 8% for rail and 4% for inland waterways. The predominance of road is even more marked in passenger transport, road accounting for 79% of the market, while air with 5% is about to overtake railways, which have reached a ceiling of 6%;*
> - *congestion on the main road and rail routes, in towns, and at airports;*
> - *harmful effects on the environment and public health, and of course the heavy toll of road accidents."*

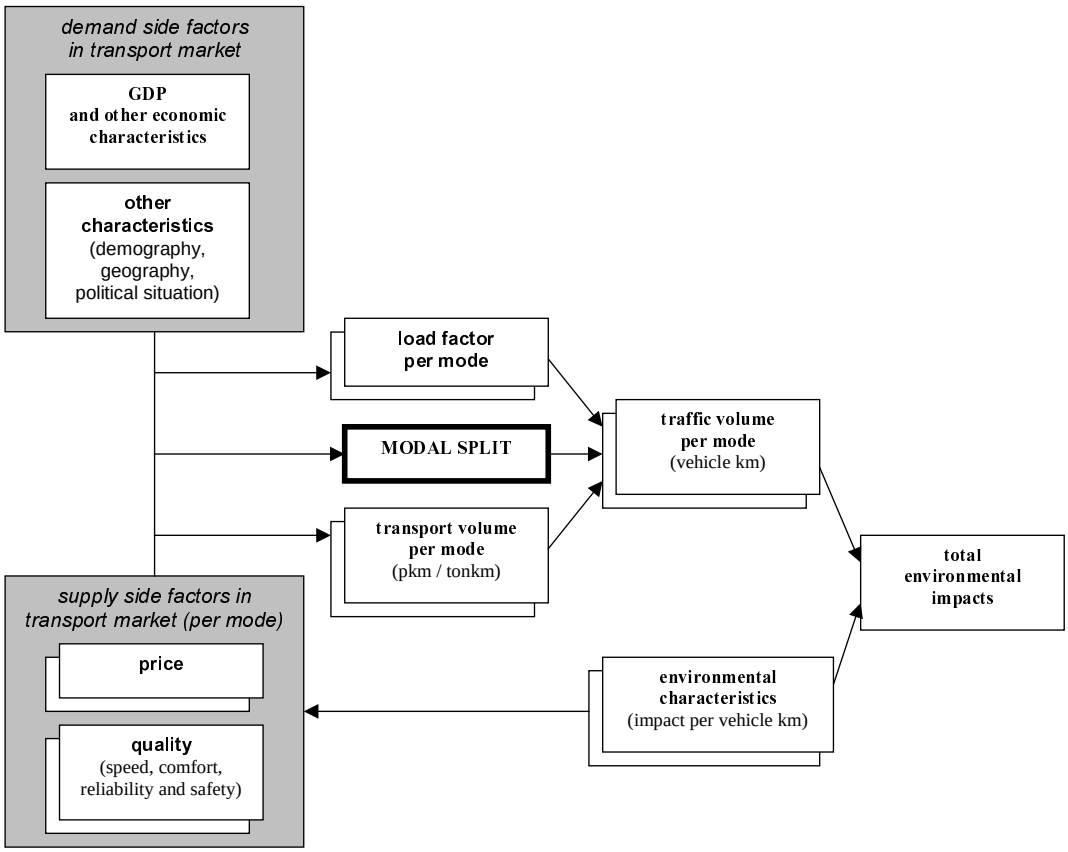
We can conclude that the focus on modal shift is intended to achieve a reduction of environmental impact (particularly CO_2), congestion and traffic accidents. Also the internalisation of external costs is put forward as an important policy target. Consequently, the most important requirement for the indicator set is that it shows the progress on these subjects, particularly the environmental impact.

2 Effective environmental transport policy

This chapter provides a framework for effective environmental transport policy. With this framework, we will assess the current indicator set.

2.1 A simple transport and environment framework

Figure 1 Conceptual model of the mechanisms behind the environmental effects of transport



Modal split depends on price and quality of the different modes

Figure 1 shows a conceptual model of the mechanisms behind the environmental effects of transport. The model considers the transport sector as a market where demand and supply determine the transport volume. The demand side is mainly determined by economic quantities like the GDP. The demand for transport is defined in terms of available time, money and preferences on quality issues. On the supply side we distinguish the different transport modes. For each mode the supply is characterised by price and quality, where quality is defined as speed, comfort, reliability and safety.

The trade-off between the total transport demand and the supply characteristics of the different transport modes determine the transport volume per

mode, which is expressed in passenger kilometre or ton kilometre. The share of each mode in the total transport volume is the modal split.

Environmental impact of transport depends on several parameters

For the environmental impact of transport, besides the modal split also the total transport volume, load factors and environmental characteristics of each transport mode play an important role. The most important environmental impacts of transport are:

- contribution to the greenhouse effect, which is mainly determined by the emission of CO_2;
- air pollution, which is mainly determined by the emission of NO_x, PM_{10} and other polluting substances;
- noise pollution;
- impact on habitats.

Figure 1 shows also a feedback effect: the environmental characteristics of a transport mode can influence the price and quality (e.g. speed and safety) of transport modes. This influence can be positive or negative. An example of this is a speed limiter on trucks: manufacturing and installation costs cause a higher price, the fuel saving effect causes a lower price and the lower speed improves traffic safety.

2.2 Ways to reduce the environmental effects of transport

Looking at the transport market as a whole, the total environmental impact can be expressed with the following formula:

Impact = GDP * Volume per GDP * Impact per volume

Impact:	Total environmental impact (e.g. ton CO_2)
GDP:	Gross Domestic Product
Volume per GDP:	Transport volume per unit GDP (in ton-km or passenger-km)
Impact per volume:	Environmental impact per ton-km or passenger-km

Considering the GDP as a given quantity, this means that the environmental impacts of the transport system can be reduced by:

- reduction of the transport volume per GDP;
- reduction of the environmental impact per unit of transport.

The transport volume per GDP is the other transport indicator of the European Sustainability Strategy, in addition to the modal split. Consequently the other transport indicator (which is now the modal split) should be a good measure for the environmental impact per unit of transport.

The environmental impact per unit of transport depends on the environmental performance of the vehicles in the transport market and on the load factors. The environmental performance of the vehicles depends on its turn on many parameters, like the type, age and technical specifications of vehicles, the way of use, the infrastructure and the environmental performance of refineries and electricity plants.

3 Environmental effects of modal shift policies: very limited and sometimes even negative

In the previous chapter we concluded that the second transport indicator of the EU sustainability strategy, in addition to the 'Volume per GDP', should be a good measure for the environmental impact per unit of transport. The modal split does not meet this requirement. 'Improvement' of the modal split - towards relatively less road and air and more rail and shipping – does not imply that Europe is moving towards a more sustainable transport system. The reasons for this are:

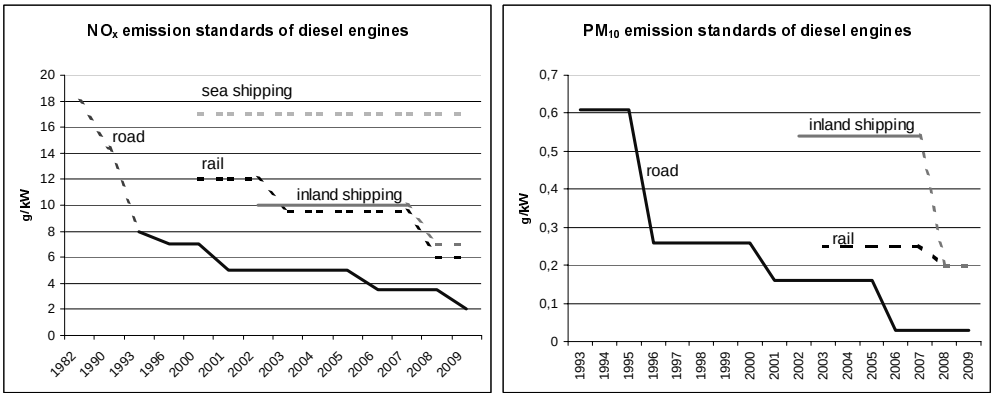
- the 'modal split' indicator ignores improvements of the environmental performances;
- differences in emissions between modes are often small;
- potential environmental effects of modal shift are very limited;
- model split is not a good measure for noise pollution.

These arguments are explained in the next sections.

3.1 Modal split ignores improvements of the environmental performances

Last decades the environmental performance of transport has changed a lot. Particularly emission standards have contributed to the reduction of emissions, setting a limit to the maximum emissions of new vehicles. Some of these standards are legal EU standards, others are voluntary or not yet consolidated in legislation.

Figure 2 NO_x and PM_{10} emission standards for diesel engines of different transport modes [RIVM, 2000], [CCR], [UIC][3]



Dashed lines indicate standards without legal status, either voluntary standards or proposed standards but not yet consolidated in legislation.

[3] The standards for sea shipping and inland shipping depend on the motor speed. We used the following typical values: sea shipping 130 rpm, inland shipping 1800 rpm. For diesel trains we used the emission standards for >560kW power and >1000 rpm.

Figure 2 shows the development of the most important emission standards for NO_x and PM_{10} for diesel engines of different transport modes[4]. This figure shows that the development of the emission standards is very different for the different transport modes.

Comparison of the emission standards does not tell us everything about the real emissions, because standards only apply to new vehicles and ships. Particularly for modes with vehicles or ships that have a long life, the reduction of the real emissions will be much smaller.

Environmental performance of road transport improves a lot

The environmental performance of *road transport* has generally improved a lot in the last decades and is expected to improve even more. The reduction of polluting emissions from passenger cars en trucks is considered as one of the most important successes of the European environmental transport policy of the last decades. The emission standards for trucks in 2009 will have been reduced by 90% since 1982 for NO_x and even by 95% since 1993[5] for PM_{10}. For passenger cars the development of emission standards is similar. This impressive progress has been made possible by many technological innovations. Without these improvements, the total NO_x emissions of road transport in 1998 would have been 50% higher.

The CO_2 emission of cars decreases at a slower rate. From 1985 to 1998, the average CO_2 emission of a passenger car decreased about 15%. Between 2000 and 2010, it is expected to fall by another 8%. For trucks the decrease is slower[6].

Rail and shipping show less progress

For *rail transport* we need to distinguish between electric trains and diesel trains. The emissions of electric trains depend for a large part on the emissions of electricity plants. For diesel trains, no EU emission standards exist. The international rail union (UIC) has emission standards that apply to their members. As can be seen in Figure 2, these standards are much less restrictive than the standards for road transport. There are plans to make them stricter in 2003 and 2008.

For *inland shipping* there are no EU standards, but the CCR (Central Commission for Navigation on the Rhine) set the first emission standards a few years ago. These standards became effective at January 2002. They have very limited effects on the emissions because they reflect more or less the current technology. Moreover, they only apply to new ships, which have usually a long life. For *sea shipping* there are no EU emission standards either. The International Maritime Organisation (IMO) has a standard for NO_x, which is not very restrictive[7].

Improvement of modes is important for reducing impact of transport

We conclude that technological innovations have led to a substantial decline of environmental impacts, particularly in road transport. In the next years, the

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4 Aviation is not included here because the emission standards for aeroplanes are not comparable to those for diesel engines.

5 Before 1993, there were no EU standards for PM_{10} emissions by trucks.

6 *TERM 2001*, European Environment Agency, 2001.

7 *Verkeer en vervoer in de Nationale Milieuverkenning*, RIVM, 2000.

environmental performance will improve even more. Also for other modes of transport, technological improvements can reduce the environmental impacts substantially.
Neither the modal split indicator nor the volume growth per GDP does reflect any of these improvements of the environmental performance of transport. Therefore the modal split is a poor indicator for sustainability.

3.2 Differences in emissions between modes are often small

It is often argued that rail and shipping have much lower emissions than road transport. In the past, this was true for the average emissions of different modes. But, as we saw in the previous section, the emissions of some modes have decreased more and quicker than of other modes. This makes that differences between modes have changed a lot and will change even more in the near future. Moreover, comparing modes on *average* emissions does not make sense. For instance, rail freight transport competes only with the part of road transport with the highest environmental performance: large long-distance trucks.

Average figures lead to misleading conclusions

Under the umbrella of road transport we can find many types of transport, varying from small vans for urban deliveries with very low load factors, to trailer combinations up to 40 tons crossing the continent. Obviously, these different types of road transport compete on different markets and have different environmental performances. For rail transport, long distance transport of bulk goods (like sand and coal) has different competitors, different load factors and different environmental performances per ton-kilometre than long, middle or short distant container transport. In addition to that, for most transport relations, transport by rail is only possible in combination with other modes.

In specific market segments and for the whole transport chain from origin to destination, differences in environmental impact between modes can be very different from the average. This is why comparison of modes, based on average load factors and average environmental performances, leads to misleading conclusions. A comparison of transport modes only makes sense for well-defined homogeneous market segments and when the whole transport chain is considered.

Differences between modes depend heavily on the specific situation

A recent research project by IFEU[8] compared the primary energy consumption and CO_2 emissions of road transport and combined transport road/rail. For typical European transport relations, the transport from origin to destination was investigated, including intermodal transfers and shunting processes. Typical kinds of combined transport were compared: rolling road, transport of semi-trailers, swap bodies and containers. Figure 3 shows the results of this study for CO_2.

The results show that generally, the primary energy consumption of combined trains with high load factors and the average European electricity mix

8 *Comparative Analysis of Energy Consumption and CO_2 Emissions of Road Transport and Combined Transport Road/Rail, Institut für Energie- und Umweltforschung (IFEU), Heidelberg, 2001.*

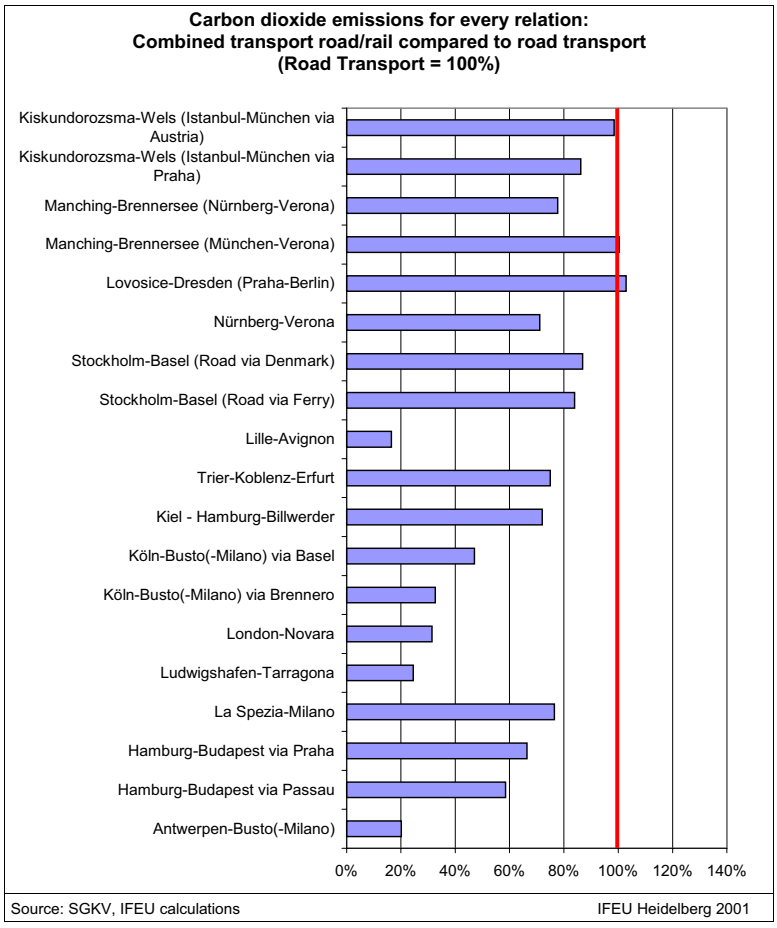
are almost equal (rolling road) or, in most cases, better (semi-trailer, swap body and container) than the lorry train/articulated truck. For 3 of the 19 routes studied, the primary energy consumption of combined transport was up to 15% higher than that of pure road transport. For the routes with a lower primary energy consumption for combined transport, in half of the cases the difference was less than 20% and in only two cases more than 40%.

For CO_2, the results are more in favour of combined transport due to a high share of nuclear and hydropower in the EU electricity mix. However, for 11 of the 19 routes, the difference was less than 30%.

This study concludes that the differences between modes are small and depend heavily on the specific situation. Therefore, it has to be decided case-specifically whether combined transport is favourable.

Figure 3 Comparison of CO_2 emissions from combined transport and road transport for several European transport relations [IFEU, 2000]

Figure 14 Carbon dioxide emissions for every relation: Combined transport road/rail compared to road transport



In some cases road has lower CO_2 and NO_x emissions, in other cases rail.

Another study, carried out in 2001 by CE-Delft, RIVM and TNO-INRO [9], also made a comparison of rail with other modes of freight transport. In this study modes are compared both on CO_2 and NO_x emissions. The most important conclusion is that the environmental performance of rail transport depends

[9] *Milieuwinst op het spoor*, CE-Delft, RIVM and TNO-Inro, 2001.

heavily on the speed of the trains, the type of goods, the traction of the trains (diesel or electric) and the rate in which other modes become cleaner. In some cases road transport shows lower CO_2 and NO_x emissions, while in other cases rail transport scores better.

Figure 4 shows the results for the CO_2 and NO_x emissions of different modes for both the bulk market and the container market. For each transport mode the whole range from best case to worst cases has been plotted. For bulk transport, inland shipping and rail show significant lower emissions than road transport. For container transport, the differences between the modes are very small and depend for a large part on the load, speed and other factors.

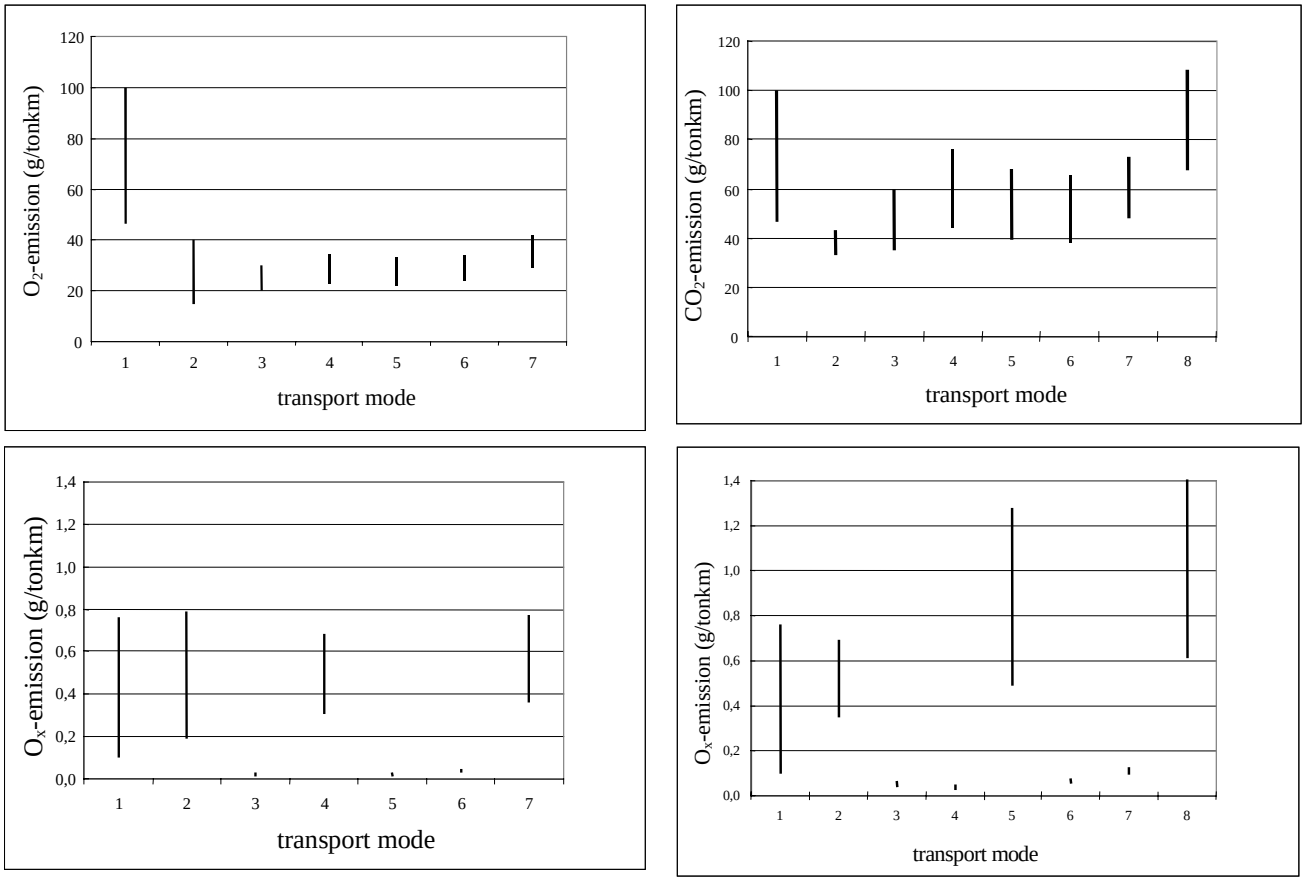
For NO_x the results show a large difference between electric trains and diesel trains. While electric trains have much lower emissions, the NO_x emissions of diesel trains are in roughly in the same range (bulk) or in a higher range (container) than of road transport.

In emerging markets environmental differences are small

The most important growth in rail transport can be found in the market for containers and swap bodies. Exactly in these markets the differences in environmental performance are small. This means that in the emerging markets modal shift does not lead to substantial reduction of the environmental impacts.

Figure 4 CO_2 emission per tonkm of different freight transport modes in bulk market and container market.

Bulk transport (existing market) *Container transport (growth market)*



Legenda			Legenda		
1	Road	Best case: 18 ton load; Worst case: 8 ton load	1	Road	Best case: 18 ton load; Worst case: 8 ton load
2	Inland shipping	Best case: push tug with 4 dumb barges, 6.000 ton load; Worst case: 'Europa ship', 500 ton load	2	Inland shipping	Best case: 'JOWI' 2.500 ton load; Worst case: 'Europa ship', 400 ton load
3	Rail	Best case: electric, 60 km/h, no detour, no transport to and from loading points	3	Rail	Best case: electric, 80 km/h, no detour, 5% transport to and from loading points
4	Rail	Diesel-electric, 80 km/h, no detour, no transport to and from loading points	4	Rail	Electric, 100 km/h, no detour, 5% transport to and from loading points
5	Rail	Electric, 80 km/h, 10% detour, no transport to and from loading points	5	Rail	Diesel-electric, 80 km/h, no detour, 5% transport to and from loading points
6	Rail	Electric, 80 km/h, no detour, 10% transport to and from loading points	6	Rail	Electric, 80 km/h, 10% detour, 5% transport to and from loading points
7	Rail	Worst case: Diesel-electric, 80 km/h, 10% detour, 10% transport to and from loading points	7	Rail	Electric, 80 km/h, no detour, 20% transport to and from loading points
		All rail cases are with 400 resp. 1000 ton bulk load	8	Rail	Worst case: diesel-electric, 100 km/h, 10% detour, 20% transport to and from loading points All rail cases are with 150 resp. 350 ton load in containers or swap bodies.

3.3 Potential environmental effects of modal shift are very limited

The logistical potential is for modal shift is hard to predict. The share of different modes is very different in the various EU countries and also the potentials of rail and shipping will be different for each Member State.

In general we can say that the often-discussed shift from road to rail is limited to large quantities of goods over long distances. The average ton of

goods trucked travels 110 km[10], a distance for which rail and inland shipping are less efficient, because of detours and transport to and from loading points, which is generally made by truck. Last years, road freight has been growing at 5% a year and to absorb just one year's growth rail would have to double its current transport volume.[11] These figures illustrate that modal shift is only eligible in certain segments and for a limited market share.

Focusing on modal shift limits environmental policy to a small part of the transport market

The fact that modal shift only is eligible for certain segments of the transport market, means that potential environmental effects of modal shift are also very limited. All the more since that the environmental differences in these segments are smaller than the average. An environmental policy based on modal shift does not touch the major part of the transport market.

Doubling market share of rail reduces CO_2-emission of freight with 1 to 2%

The market share of rail is currently 8% of the total European freight transport. If this current share of rail in European freight transport were to double to 16% - an immense effort, given the 2010 target of stabilising the modal split presented in the Common Transport Policy for 2010 - total CO_2 emissions from European freight transport would decrease by between 1 and 2%[12]. NO_X and PM_{10} emissions and noise may increase or decrease, depending on such factors as technology, load factors and the location of the road and rail transport involved. This example shows how limited the ultimate environmental effects of modal shift are.

3.4 Model split is not a good measure for noise pollution

Noise pollution: an important environmental problem

Besides emissions of combustion gases, noise pollution is also an important environmental issue. According to TERM 2001, about 120 million people in the EU (more than 30% of the total population) are exposed to *road traffic* noise levels above 55 L_{dn} dB, which means that they are highly annoyed. It is estimated that 10% of the EU population is exposed to *rail traffic* noise above 55 L_{Aeq} dB and about 10% may be highly annoyed by *air traffic* noise.

Noise pollution of rail is often higher than road

These figures show that noise pollution is still a very important environmental problem in Europe. In absolute terms, road transport is responsible for the largest share of noise pollution. However, these figures show also that rail transport and air transport are responsible for an important share of noise pollution. Taking into account that road has a 5 to 10 times higher market

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10 *TERM 2001*, European Environment Agency, 2001.

11 *Government and Railway Company Action Rail Growth*, Stephen Perkins, ECMT principle administrator, Parliamant Magazine No. 124, 24 September 2001.

12 Based on the transport volume (2960 billion tonkm) and total CO_2 emission (300 million ton) of freight transport in Europe from *TERM 2001*, European Environment Agency, 2001. The calculation assumes an average CO_2 reduction of 20g/tonkm, which is the average difference between road and rail in the container market in both the IFEU and CE/RIVM/TNO study. The figure does NOT take into account the fact that new rail of waterway infrastructure may generate new transport with new environmental impacts.

share than rail, the share of rail in noise pollution is relatively large with respect to the transport volume.

No noise emission standards for rail

Since 1970, there are EU noise emission standards for new passenger cars and trucks, which have become stricter over the years. Also for air transport, European noise emission standards exist. Contrary to road vehicles, there are no noise emission standards for trains (except for High Speed Trains). Particularly for freight transport many relative old and noisy trains are used. Finally, in case of freight transport, trains run more frequently through city centres, causing more noise nuisance than their competitors, long-distance trucks.

The modal split indicator does not give any information about the level of noise pollution by transport in Europe. By neglecting this important environmental problem the modal split is not a good indicator for the European sustainability strategy.

3.5 Conclusion

Environmental transport policies aimed at modal shift are very limited and not effective. The logistical potential for modal shift from road and air to rail and shipping is limited, because modes compete only on specific segments of the transport market. This makes that the potential environmental effects of modal shift are very limited too. All the more since the environmental differences between modes are small, particularly in these specific market segments where modal shift is possible.

We conclude that environmental policy based on modal shift does not touch the major part of the transport market and has potentially only very small environmental effects that can even be negative.

A more substantial reduction of the environmental impact of transport can be achieved by improving the environmental performances of individual modes. This has already resulted in significant progress in the last decades, particularly for road transport. Improving the environmental impact of all modes has more impact and, moreover, is applicable to a much broader range of transport situations.

4 Alternative indicators

4.1 Requirements for an alternative indicator

As concluded before, the alternative for the modal split indicator should be a good measure for the environmental impact per unit of transport. This is the most important requirement for the alternative indicator.

Another important requirement is that the indicator values can be reported with a limited number of graphics. The current indicator, modal split, is implemented as a set of three graphs:

- modal split of freight transport: percentage share of road;
- modal split of passengers transport: percentage share of cars;
- modal split of passengers transport: percentage share of aviation.

For a useful alternative indicator, probably a few more graphs are needed.

4.2 Recommendations

In the short term, the most promising alternative for the modal split indicator seems to be:

- total emissions of CO_2, NO_x and PM_{10} per passenger kilometre and ton kilometre;
- percentage of the EU population exposed to a transport-related noise level above 55 dB[13].

The emission figures should be based as much as possible on practical research or otherwise on results of test cycles that give reliable figures for real emissions.

There are no international accepted parameters for noise pollution per unit of transport volume. Therefore the proposed noise pollution part of the indicator is not relative to the transport volume. The European Commission is currently working on harmonisation of the different noise indices, which are used in the EU. This should lead to two indices: L_{den} and L_{night}. The noise pollution part of the indicator could be based on these harmonised indices. This is in line with the approach for the noise indicator that the EEA proposes in TERM 2001[14]. The noise pollution data based on these uniform indices will probably not be available before 2006.

This dual indicator is related more directly to the environmental impact and would act as an incentive for *all* possible options for making transport really cleaner - including modal shift.

The proposed alternative indicator shows the environmental performance of the whole transport system. For the EU Sustainability Strategy, this highly aggregated indicator is very suitable. For policy makers, also some less aggregated indicators are important, like the relative emissions for each transport mode separately (including some other emissions like SO_2) and the

[13] This noise level is mostly used as the maximum level to which people should be exposed.

[14] *TERM 2001*, European Environment Agency, 2001.

noise emissions of several sources. However, these indicators are beyond the scope of the indicator set of the EU Sustainability Strategy.

In the longer term, an ideal indicator would be the total external costs per passenger or ton kilometre. With this indicator, all environmental effects and even safety aspects could be expressed in a single figure. It is also in line with the call for full internalisation of social and environmental costs.

However, lack of a uniform method for calculating external costs and the unavailability of the required data in many Member States means that this indicator is not yet a practical feasibility.

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Towards a more sustainable transport indicator

Critical assessment of the modal split as an indicator for the EU Sustainability Strategy

Annexes

Report

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A Structural indicators of the EU sustainability strategy

General Economic Background a. GDP per capita (in PPS) and real GDP growth rate b. Labour productivity (per person employed and per hour worked) c. Unemployment rate d. Inflation rate e. Real unit labour cost growth f. Public balance
I. Employment 1. Employment rate (total and by gender) 2. Employment rate of older workers 3. Gender pay gap 4. Tax rate on low-wage earners 5. Life-long learning (adult participation in education and training) 6. Accidents at work (quality of work)
II. Innovation 1. Public expenditure on education 2. R&D expenditure 3. Level of Internet access 4. Science and technology doctorates 5. Patents 6. Venture capital
III. Economic Reform 1. Relative price levels and price convergence 2. Prices in the network industries 3. Market structure in the network industries 4. Public procurement 5. Sectoral and ad hoc State aid 6. Capital raised on stock markets
IV. Social Cohesion 1. Distribution of income (income quintile ratio) 2. Poverty rate before and after social transfers 3. Persistence of poverty 4. Regional cohesion 5. Early school-leavers not in further education or training 6. Long-term unemployment
V. Environmental Aspects of Sustainable Development 1. Greenhouse gases emissions 2. Energy intensity of the economy *3. Volume of transport (tonnes and passenger km) relative to GDP* *4. Modal split of transport* 5. Urban air quality 6. Municipal waste