ASSESS

Assessment of the contribution of the TEN and other transport policy measures to the mid-term implementation of the White Paper on the European Transport Policy for 2010

FINAL REPORT
ANNEX XVII INDICATORS

European Commission
DG TREN
DM 28
1043 Brussels
Belgium

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TRANSPORT & MOBILITY LEUVEN

TRANSPORT & MOBILITY LEUVEN
VITAL DECOSTERSTRAAT 67A BUS 0001
3000 LEUVEN
BELGIË
+32 (16) 31.77.30
http:\\www.tmleuven.be

and:

TNO, Netherlands
WSP, UK
TRT, Italy
DLR, Germany
University of Gdansk, Poland
ITS Leeds, UK
SWOV, Netherlands
CAU Kiel, Germany
Istanbul Technical University, Turkey

Preface

This is ANNEX XVII of the final report for *'Assessment of the contribution of the TEN and other transport policy measures to the mid-term implementation of the White Paper on the European Transport Policy for 2010'.*

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Authors:

Griet De Ceuster, TML, Belgium
Jens Borken, DLR, Germany
Arnaud Burgess, TNO, the Netherlands
Bart Van Herbruggen, TML, Belgium

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Scope

Scope of the ASSESS project

The ASSESS study is about the ***"Assessment of the contribution of the TEN and other transport policy measures to the mid-term implementation of the White Paper on the European Transport Policy for 2010"***.

The European Commission's White Paper of 12.9.2001 "European transport policy for 2010: time to decide" aims to promote a sustainable transport policy. The White Paper proposes to achieve sustainability by gradually breaking the link between transport growth and economic growth, principally in three ways: changing the modal split in the long term, clearing infrastructure bottlenecks, and placing safety and quality at the heart of the transport policy.

As foreseen, the White Paper on Transport undergoes in 2005 an overall ***assessment concerning the implementation of the measures it advocates and to check whether its targets*** - for example, on modal split or road safety - ***and objectives are being attained or whether adjustments are needed.***

ASSESS provides technical support to the Commission services for the above mid-term assessment of the White Paper.

The analysis accounts for the economic, social and environmental consequences of the proposed measures and their contribution to sustainable development objectives. It provides also a detailed analysis of those effects of enlargement likely to affect the structure and performance of the EU transport system.

The study takes a three pillar approach based on the use of analysis, indicators and models. National transport policies are reviewed for compatibility and coherence with the White Paper objectives. The models used allow a detailed analysis of the freight market, the passenger market and their infrastructure networks under a number of scenarios.

Scope of this Annex

The effects of the measures in the White Paper on the objectives have been assessed with a modelling and indicator approach.

This report focuses on the economic, social and environmental consequences of the White Paper measures and their envisaged and actual contribution to sustainable development objectives for EU25. The objectives with respect to implementing measures are being addressed in Annexes I and II.

For each of the four scenario's (see Annex V), the impact on relevant indicators in given, based on the modelling with SCENES (Annex VI), TREMOVE (Annex VII), CGEurope (Annex VIII), SLAM (Annex IX), the TNO noise model (Annex X), the SWOV safety model (Annex XI), the ASTRA model (Annex XII), and a variety of statistics and literature.

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ANNEX XVII Indicators

Authors:

Griet De Ceuster, TML, Belgium

Arnaud Burgess, TNO, the Netherlands

Jens Borken, DLR, Germany

Ralf Hedel, DLR, Germany

Bart Van Herbruggen, TML, Belgium

XVII.1. Introduction and approach

The White Paper was published in 2001 and presented a number of objectives to be achieved in 2010.

The mid-term evaluation has two objectives. Firstly, it is assessed to what extent the implementation activities in the period 2001-2005 are in conformance with what has been proposed in the White Paper and secondly, it is assessed whether the objectives are still feasible, taking into account the policy and trend developments in the past period.

For this second objective, the developments in the transport sector are estimated for 2010 and 2020, based on 4 different future projections (scenarios)

Therefore, this report provides an overview of the impact of the White Paper on the evolution of the transport situations, and on the effects on the environment, social effects and economic effects. Both the past developments (1990-2005) and future projections (2005-2020) are assessed.

Whilst it is important to maintain an overview, it is crucial to remember the starting point and the local circumstances for individual Member States have been very different. Broadly speaking in the context of the White Paper, it is useful to point out the in the EU15 there have been nearly 5 years of implementation, whilst the NMS only joined the EU in 2004. Furthermore, the development trajectories are likely to remain different for some considerable time to come.

XVII.1.1. The White Paper objectives in a general perspective

The White Paper on transport also impacts on the more wider economic, social en environ-mental goals of the community. Some of these wider goals are explicitly mentioned in the White Paper such as:

- Lisbon Strategy (2000)
- Gothenburg European Council (2001)
- Kyoto protocol (1997, ratification in 2002)

The Lisbon Strategy (2000) is a commitment to bring about economic, social and environ-mental renewal in the EU. In March 2000, the European Council in Lisbon set out a ten-year strategy to make the EU the world's most dynamic and competitive knowledge-based economy. Under the strategy, a stronger economy will drive job creation alongside social and environ-mental policies that ensure development and social cohesion. The fundamental objectives of the Lisbon "process" include the completion of the internal market in transport, infrastructural development, the organisation of safety and security and the implementation of policies favourable to their sustainable development.

The Gothenburg European Council (2001) agreed on a strategy for sustainable development and added an environmental dimension to the Lisbon process for employment, economic re-form and social cohesion. Sustainable development was defined as, in compliance with the Brundland Commission's (1997), "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". The Gothenburg European Council reaffirmed the EU's commitment to delivering on Kyoto targets and the realisation by 2005 of demonstrable progress in achieving these commitments. The council agreed that 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. The Council further stated that 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.

It was agreed that a sustainable transport system is one that:

- Allows the basic access and development needs of individuals, companies and societies to be met safely and in a manner consistent with human and ecosystems health, and promises equity within and between successive generations;
- Is affordable, operates fairly and efficiently, offers choice of transport mode, and supports a competitive economy, as well as balanced regional development.
- Limits emissions and waste within the planet's ability to absorb them, uses renewable resources at or below their rates of generation, and, uses non-renewable resources at or below the rates of development of renewable substitutes while minimising the impact on land and the generation of noise (Council of the EU, 2001).

Under the Kyoto Protocol (1997), the EU committed itself to reducing its greenhouse gases emissions (of which CO2 is the most important one) by 8% below 1990 levels during the first commitment period from 2008 to 2012. This target is shared between the Member States under a legally binding burden-sharing agreement, which sets individual emissions targets for each Member State. On 31 May 2002, the EU and all its Member States ratified the Kyoto Protocol. The ten accession countries scheduled to join the EU in May 2004 all have ratified the Kyoto Protocol and have their own Kyoto targets of between 6% and 8%. The EU's 8% target only refers to the current 15 Member States, and this will not change after enlargement. It should be noted that CO2 emissions from transport increased by 18% between 1990 and 2000, with a share in total greenhouse gas emissions of 21%. So in transport there is a long way to go to meet the Kyoto targets.

XVII.1.2. Objectives of the White Paper on Transport

This section presents a summary of the objectives, policies and measures in order to enable policy evaluation. The core of the White Paper consists of four chapters that each introduce one action priority of the Commission. The following four action priorities are distinguished.

XVII.1.2.1. Action priority 1: Shifting the balance between modes of transport

The White Paper argues that increasing success of road and air transport is resulting in ever worsening congestion, while, paradoxically, failure to exploit the full potential of rail and short-sea shipping is impeding the development of real alternatives to road haulage. This persisting situation is leading to an uneven distribution of traffic generating increasing congestion, particularly on the main trans-European corridors and in towns and cities. To solve this problem, the White Paper aims to gradually break the link between road transport growth and economic growth by shifting the balance between the modes towards the more sustainable transport modes, i.e rail transport and maritime transport (incl. short sea shipping). For the period between 1998 and 2010 the White Paper measures aim to result in at a road haulage growth of 35% and a passenger car transport growth of 21% against a rise in GDP of 43% (p. 16).

To achieve the general objective of shifting the balance between the modes of transport the Commission introduced a number of policy guidelines. The policy guidelines belonging to the first action priority are:

1. *Improving quality in the road transport sector.* Protecting carriers from pressure form consigners[1] and bringing about modernization of the way in which road transport services are operated, while complying with the social legislation and the rules on workers' rights.
2. *Revitalizing the railways.* Opening up the markets, not only for international services, but also for cabotage on the national markets and for international passenger services. And second, restoring the credibility, in terms of regularity and punctuality of this mode, particularly for freight. It should enable to make rail transport more competitive in the transport system, also considering the context of the enlargement[2].
3. *Striking a balance between growth in air transport and the environment.* Reorganisation of Europe's sky and ensuring the expansion of airport capacity remains subject to demands of reduction of noise and pollution caused by aircraft.
4. *Promoting transport by sea and inland waterway***.** Reinforcing the position of these two modes by improving infrastructure and harmonizing social rules and technical requirements.
5. *Turning intermodality into reality.* Technical harmonisation and interoperability between systems, particularly for containers and support for innovative initiatives.

Large events that occurred after the publishing of the White Paper (the attacks on the Twin Towers on 11/9/2001 and the maritime accidents of the Erika and the Prestige) have resulted in the adoption of an extra guideline in the field of security and maritime safety. The objectives[3] are improvement in maritime safety in order to prevent large scale disastrous accidents and improved aircraft safety and management of air navigation. These objectives were already included under policy guideline 3 and 4 but became more prominent due to the event mentioned above.

XVII.1.2.2. Action priority 2: Eliminating bottlenecks

The White Paper argues that unless infrastructure is interconnected and free of bottlenecks, to allow the physical movement of goods and persons, the internal market and the territorial cohesion of the Union will not be fully realised. Even though the European Union has adopted an ambitious policy on the trans-European network a number of bottlenecks remain on the main international routes. Therefore the White Paper aims to unblock the major routes, among others by mobilizing enough capital.

[1] White Paper, pg. 25: In this context, harmonisation of transport contract minimum clauses regarding the passing-on of costs should help protect carriers from pressure from consignors. In particular, transport contracts should include clauses allowing, for example, revision of tariffs in the event of a sharp rise in fuel prices.

[2] Page 88 of the White Paper says: Every effort must therefore be made to convince the countries in question of the need to maintain the railways' share of the freight market at a high level, with a target of around 35 % for 2010. And: Maintaining the modal share of the railways in the candidate countries will also require even firmer action on road transport.

[3] Source: DGTREN, Energy and Transport, Report 2000-2004.

The related policy guideline mentioned in the White Paper is:

6 *Building the trans-European transport network*. The main aims are: removing the bottlenecks in the railway network, completing the routes identified as the priorities for absorbing the traffic flows generated by enlargement, particularly in frontier regions, and improving access to outlying areas. Priority is given to freight and a high-speed network for passengers. The main obstacle to carrying out infrastructure projects, apart from technical or environmental considerations, remains the difficulty of mobilising capital. To overcome this problem, the White Paper argues that innovative methods of public-private funding must be applied.

The guideline contains a number of more detailed objectives, such as

- completing the routes identified as the priorities for absorbing the traffic flows generated by enlargement, particularly in frontier regions, and improving access to outlying areas
- developing a high-speed rail network, removing the bottlenecks in the railway network
- developing motorways of the sea and airport capacity, including sections of pan-European corridors situated on territory of candidate countries
- developing multimodal corridors giving priority to freight
- developing traffic management plans for all main trans-European links
- completing the Alpine routes and providing a better passage of the Pyrenees by providing a high capacity rail line
- improve safety of long tunnels in the TENs
- enlarge private funding in the TENs

XVII.1.2.3. Action priority 3: Placing users at the heart of transport policy

The White Paper puts much emphasis on putting the users back at the heard of transport policy. Whether they be members of the public or transport sector professionals, everyone should enjoy a transport system that meets their needs and expectations. The White Paper puts the emphasis on, what is argued to be the users prime concern, road safety. Furthermore the paper mentions users costs, user rights and obligations and clean (public) transport accessibility. The policy guidelines belonging to this action priority are:

7 *Improving road safety*. Of all modes of transport, transport by road is the most dangerous and the most costly in term of human lives. This is also one of the few policy where the White Paper mentions a quantitative target. It is aimed to reduce the number of deaths on the road with 50% (p19, 66, 67).

8 *Adopting a policy on effective charging for transport*. Transport uses are entitled to know what they are paying for and why. Therefore Community action aims at gradually replacing existing transport system taxes with more effective instruments for integrating infrastructure costs and external costs.

9 *Recognising the rights and obligations of users*. The White Paper aims to define users' rights in all modes of transport, while also considering whether in future it might also introduce user obligations. The White Paper aims to lay the foundation for helping the transport users to understand and exercise their rights and in return also defining certain safety-related obligations.

10 *Developing high quality urban transport*. Noise and air pollution and its effects on health are of greater concern in towns and cities. Given the constraints of the principle of subsidiarity, the White Paper intends to encourage the exchange of good practice and taking regulatory initiatives to encourage public transport.

11 *Putting research and technology at the service of clean, efficient transport*. Adoption of stricter standards for noise, safety and emissions. And secondly integrating intelligent systems in all modes to make for efficient infrastructure management. Some quantitative targets are mentioned. By 2020 20% of the conven-

tional fuels should be substituted by alternative fuels and by 2010 there should be a 6% biofuel penetration rate (p83).

XVII.1.2.4. Action priority 4: Managing the globalization of transport

Much of transport is regulated at the international level. Over the last two centuries, the regulatory framework has been built up within intergovernmental organisations. This is one reason why it is hard for the common transport policy to secure a position between, on the one hand, the production of international rules within established organisations and, on the other, national rules which often seek to protect domestic markets. With the enlargement and the extension of transport policy and trans-European network across the continent, Europe needs to rethink its international role. Firstly. the White Paper aims to make the enlargement of the Union a success by linking the new Member States to the trans-European network and secondly making the enlarged Europe more assertive on the world stage. The policy guideline belonging to this action priority is:

12. *Managing the effects of globalisation.* Reinforcing the position of the Community in international organisations in order to safeguard Europe's interests at world level. The White Paper puts emphasis on achieving independence in the field of satellite radio navigation.

This includes:

- Having a single voice of the EU in intergovernmental organisations which govern transport
- Coordinating air transport agreements with non-European countries (p94)
- Developing an European satellite nagivation system (GALILEO)

XVII.1.3. Approach

The effects of the measures in the White Paper on the objectives have been assessed with a modelling and indicator approach.

First, the objectives in the White Paper have been quantified into indicators. This report focuses on the economic, social and environmental consequences of the White Paper measures and their envisaged and actual contribution to sustainable development objectives. The objectives with respect to implementing measures are being addressed in Annexes I and II.

For most sustainability objectives the White Paper has at least defined the preference direction, for a few there are quantitative targets given. Many White Paper objectives concern however organisational issues which are considered in the study as means to achieve the overall ends. Of these overall ends, only very few are precisely quantified.

The key question of the indicator assessment is whether the objectives as stated for this area in the White Paper are attained, i.e. if the proposed and implemented ensemble of measures has been and will be effective. The indicators are used to measure – quantitatively, if model results or other data are available, otherwise qualitatively – the degree of target achievement over the range of the objectives. of the White Paper, notably the sustainability objectives.

Four scenarios have been developed, in increasing level of ambition:

(i) Null scenario (N-scenario): assumes that none of the White Paper measures has been implemented.

(ii) Partial implementation scenario (P-scenario)[4]: includes only measures that are assumed to be implemented before 2010. This scenario is what – under current conditions – will actually happen in the future.
(iii) Full implementation scenario (F-scenario): includes all White Paper measures.
(iv) Extended scenario (E-scenario): for most measures the extended scenario follows the full scenario while for some measures the partial scenario is followed because there is no indication that the full implementation is feasible. Additional to this two policy changes has been introduced.

All four scenario's are developed for 2010 (the time-horizon of the White Paper). Sometimes the implementation and the impact of measures takes time. For example, some of the TEN-projects have been started within the period 2000-2010 but they will be finalised in the period 2010-2020. Also pricing for passenger road transport in the extended scenario will only be introduced in from 2011 onwards. To show the impacts of these measures the scenarios are developed and evaluated for both the year 2010 and 2020.

The impact of each measure on relevant transport sector variables are quantified by using various literature sources, among others the results of several European projects. Estimations have been made with regard to the size of the impact when a measure is not fully implemented yet. In table x the estimated impacts of the four policy scenarios on travel costs respectively travel times are presented. These values are used to compute with, amongst others the SCENES and TREMOVE model, the impacts on the transport sector (modal shares etc.) as well as various economic, social and environmental impacts of the policy scenarios.

A detailed report on the measures in each scenario and the quantification can be found in Annex V.

These scenarios have been analysed with a set of models, of which the core model was the SCENES transport model. The SCENES output then was processed into TREMOVE (vehicle stock, emissions, fuel consumption, government revenues), CGE (regional welfare), SLAM (logistics), a noise model, the SWOV road safety model and a macro-economic model.

The results of these model runs, and an analysis of these results, can be found in several Annexes, and in the indicators described in this report.

It has to be noted that the White Paper itself does not produce evidence that the measures put forward are the most cost effective ways of achieving the policy objectives. A cost-effectiveness analysis is also not the subject of our indicator study. The results should be therefore looked at in the light of this.

XVII.1.4. Indicators for the White Paper objectives

For most the White Paper has at least defined the preference direction, for a few there are quantitative targets given. Many White Paper objectives concern however organisational issues which are considered in the study as means to achieve the overall ends. Of these overall ends, only very few are precisely quantified.

Hence for most objectives our analysis is confined to a gradual assessment, whether the indicator, as a function of the degree of implementation of the policy, develops more in the sense of the preference direction for the objective in question, or less. As the four scenarios are constructed in a nested manner, i.e.

[4] The Partial A scenario. The Partial B scenario is discussed in Annex V and VI, but not in the indicator assessment.

from scenario null over partial to full and finally the extended scenario the scope, degree and intensity of the various White Paper measures increases. A comparative analysis of the outcomes, as represented by the indicators, reveals the impact of the policy or policy package that has been added by going from one scenario to the other. Not surprisingly, the modelled impact increases as well from one scenario to the other, i.e. develops further and further in the preference direction defined by the objectives. However, some policies reveal themselves more effective than others.

For EU15 countries one can apply the White Paper objectives directly as they have been formulated for these countries. The new Member States (NMS10) however come from different starting level and have had much less time for the implementation of measures. Therefore, this analysis looks more for their pattern, their growth rates and mode or vehicle specific developments. The EU15 and NMS10 figures will be reported separately for this reason.

The table below gives an overview of the indicators that could be calculated form the modelling work in ASSESS and the White Paper[5] objectives that relate to them. In the following chapter , they will in compared with the modelling data as summarised in the indicators.

The list of indicators does not only cover the specific WhitePpaper objectives, but also the wider sustainability objective. As the White Paper's final objective was to ensure the sustainability of transport in terms of environmental damage, safety and congestion, despite the foreseeable growth in transport volume and without restricting (too much) mobility, the results against these objectives are also assessed.

Table 1: ASSESS indicators and the related quantified objectives of the White Paper

Indicator	Scope	Unit	Quantitative objective in the White Paper
Transport volume	freight • rail • road • inland waterways • sss	tkm	• Breaking the link between the growth of car transport and economic growth: road haulage +35 % instead of predicted 50 %.
	passengers • car • bus/coach • train/metro • air • walk/cycle	pkm	• Passenger car transport +21 % against a rise in GDP of 43 %. • Maintain and improve the competitive position of Europe's air industry by creating of the single European sky and regulating the unavoidable expansion of airport infrastructure. *(White Paper p. 37)*
Modal share	freight • rail • road • inland waterways	% of tkm	• Realising a modal shift from road and air to rail and water by providing fair competition between modes and link-up modes for successful intermodality. • Maintain rail freight market share in the central and eastern European countries (35 %). *(White Paper p. 89)* • Raising the modal share of short sea shipping by linking up waterways on sea with an inland traffic. *(White Paper p. 12, 27, 41-42)* • Raising the modal share of inland waterway transport f. ex. by establishing 'waterways branches' and transhipment facilities. *(White Paper p. 12, 41-42)* • Improve the organisation of intermodal transport.

[5] White Paper: main text (up to page 97) as well as the annexes (from page 98), English version.

	passengers • car • bus/coach • train/metro • air • walk/cycle	% of pkm	• Realising a modal shift from road and air to rail and water by providing fair competition between modes and link-up modes for successful intermodality. *(White Paper p. 45-46, 104)* • Increase rail market share of passenger traffic (6 % → 10 %) and goods traffic (8 % → 15 %) *(White Paper p. 25, 27)* • Stimulating rail usage by increasing the quality *White Paper p. 30)* • Better use of public transport and rational use of the car.
Transport intensity	freight	pkm/population	• No quantitative targets
	passengers	tkm/ton	• No quantitative targets
Economic growth		GDP	• No quantitative targets
Employment		working places	• No quantitative targets
Spatial distribution of economic impacts		GDP/capita	• Completing the routes identified as the priorities for absorbing the traffic flows generated by enlargement, and improving access to outlying areas *(White Paper p.18 and 50)*
Transport growth and decoupling	passengers freight	pkm/GDP tkm/GDP	• Internalisation of external costs by gradually replacement of existing transport taxes with infrastructure charges and fuel taxes *(White Paper p. 16)*
Accessibility		hours	• Removing the bottlenecks in the railway network. *(p. 50-51)* • Developing motorways of the sea and airport capacity. *(White Paper p. 50-51)* • Completing the Alpine routes and providing a better passage of the Pyrenees. *(White Paper p. 53)* • Everyone should enjoy a transport system that meets their needs and expectations, in terms safety, costs, user rights and obligations and clean (public) transport accessibility.
Vehicle stock and ownership	• car • truck		• No quantitative targets
Safety	road	# fatalities	• Everyone should enjoy a transport system that meets their needs and expectations, in terms safety, costs, user rights and obligations and clean (public) transport accessibility. • Reduce the (human) costs of traffic accident and the number of deaths on the road with 50 %. *(White Paper p. 66)* • Improve safety of long tunnels in the TENs. *(White Paper p. 58)*
Energy consumption		ktoe	• Raising the share of substitute fuels (6 % biofuel penetration rate by 2010) *(White Paper p. 83)* • Replacement of 20 % of conventional fuels with substitute fuels by 2020 *(White Paper p. 83)*
Climate change		ton GHG	• No quantitative targets[6]
Air quality		ton Nox, PM, SO2	• No quantitative targets • Everyone should enjoy a transport system that meets their needs and expectations, in terms safety, costs, user rights and obligations and clean (public) transport accessibility.
Noise exposure		% Ln>55dB(A)	• No quantitative targets
Land take and fragmentation	road	km²	• Everyone should enjoy a transport system that meets their needs and expectations, in terms safety, costs, user rights and obligations and clean (public) transport accessibility.

[6] The White Paper happens to have on p. 166 (Annex IV) targets on air transport: reducing CO2 emissions by 50% in absolute terms, reducing NOx emissions by 80%, reducing aircraft noise by 10 dB / reduce the perceived noise level by 50 %. These targets are aspirational targets proposed by ACARE - the Advisory Council on Aeronatics Research in Europe. They are research targets indicating what new technology available in 2020 should attain, not at all average performance of in-service fleets. They do not belong to the common transport policy and are not assessed in this study.

XVII.2. Summary and conclusions

This chapter gives an overview to what extent the White Paper objectives of reducing congestion and bottlenecks, greenhouse gases, conventional air pollution and noise pollution as well as improving safety and quality for transport users and those affected by the use of transport may be attained.

The table below summarise the transport, economic, social and environmental consequences of the White Paper measures. The main source for the figures is the modelling results of the four scenarios for both passenger and freight in EU15 and EU10.

Table 2: Transport performance in EU25 for all 4 scenarios, relative to 2000(=100)

EU25		1990	1995	2000	2005	2010				2020			
						N	P	F	E	N	P	F	E
pkm	pkm/year	82	88	100	108	117	117	118	118	135	135	136	127
tkm	tkm/year	83	88	100	108	117	116	116	116	139	136	133	131
intensity pass.	pkm/population			100	107	114	114	115	115	130	130	131	123
intensity freight	tkm/ton			100	102	103	100	100	100	113	107	107	103
accessibility (travel time)	hours			100	99	99	98	96	95	98	97	95	94
GDP (baseline)	euro			100	113	127	127	127	127	162	162	162	162
GDP+ (impact)	euro			100	113	127	134	134	134	162	163	164	165
employment (baseline)	euro			100	104	108	108	108	108	116	116	116	116
employment+ (impact)	euro			100	104	108	108	108	108	116	117	117	117
car park	1000 cars	78	88	100	106	114	114	116	116	132	132	134	124
truck park	1000 trucks	66	82	100	115	119	118	118	117	135	134	132	128
safety	road fatalities	134	112	100	86	77	68	45	28	56	49	24	13
energy	toe			100	103	102	102	102	102	107	107	106	99
CO2	ton			100	103	102	103	103	103	107	108	107	101
PM	ton			100	87	76	77	77	77	67	69	68	65
NOx	ton			100	80	63	65	64	64	49	52	51	48
SO2	ton			100	96	92	89	89	89	94	90	89	84
noise	% hindered persons			100	104	107	107	108	108	115	116	116	113
land take	km² road			100	100	102	107	120	118	107	113	123	121
fragmentation	km² road			100	100	102	110	130	130	111	120	135	134

Almost all indicators show a remarkable progress in the right direction. Road safety has come to a much better situation than it was in 2001. The emissions have dropped. Rail freight transport is growing. As expected, the scenarios have an increasing degree of impact, in parallel with the increasing degree of ambition. However, almost none of the quantitative targets set in the White Paper on transport will be reached by 2010.

It seems that the growth of **road freight transport** is lower than was expected at the time of writing the White Paper, this is explained by lower growth of the economy. When looking at the effectiveness of the White paper measures the reduction is however less than was predicted. This means that once the economic growth will increase road transport growth will be equal (so no decoupling).

For **passenger transport** the extended scenario including social marginal cost pricing for passenger transport as well will lead to attain the White Paper goals.

In order to attain the White Paper goals on **modal split** developments the policy packages in full or the extended scenario have to be implemented. A few new Member States can maintain the traditional high share of railway transport, as it used to be in the past, this can only be achieved in the policy packages in the full or even better in the extended scenario.

Congestion (average road trip time) will reduces 3.7% for freight and 0.2% for passengers in 2010 compared to 2000[7] and **accessibility** will increase (travel time between regions) when implementing the White Paper policies. When carrying out the policies in the extended scenario the effect will be the larges. Freight will gain the most, in the order of rail, road maritime, inland waterways in the NMS, in the EU15 for freight the order is inland waterway, rail, maritime and road.

With this ranking also objectives concerning **intermodality** are attained. Overall the reduction of travel times for freight amount to 4.9% in the EU25 in 2010 in the extended scenario leading to a more efficient use of the network and vehicle stock. For passenger transport travel times reduce with 2.0% in 2010 in the extended scenario.

The **accessibility of the regions** will increase, the extended scenario leads to a better accessibility of regions, it should be kept in mind that some peripheral regions in NMS are not equally enjoying improved accessibility as others.

The White Paper objective "breaking the **link between the growth of transport and economic growth**", aimed for a reduction **of the road freight growth between** 1998 and 2010 from the expected 50% to the desired 38%. However, the SCENES results show that the growth without White Paper policy intervention is only 23% (and not 50%), due to lower GDP growth rates than expected in the period 2001-2005. Due to the implementation of the White Paper the growth of the road freight transport is reduced with another 2.2%.

For passenger transport by car, the goal was an increase in traffic of 21% against a rise in GDP of 43%. Based on the SCENES results it is possible to confirm that the growth in car passenger transport is 17%, lower than anticipated. However, when the White Paper would be fully implemented or when the extended policy scenario would be implemented, then passenger transport by car is growing faster than the reference development of the Null scenario in 2010, but slower in 2020[8].

Implementing the measures of the White Paper is positively affecting the **EU economic growth**, particularly when marginal effects can be detected, although the impacts on **GDP and employment** are quite small. This moderately positive impact is higher when the investment and policy measures are well integrated and charging policies are compensated by a proportionate reduction of direct taxes.

The result of the analysis on **regional welfare** shows that for 2010 for all scenarios the effects on cohesion tend toward a slightly more unequal distribution of GDP/capita and the Gini-coefficient, with regions where we observe above average negative impacts as well in the periphery as well as in the centre of Europe. However, cohesion indicator values are rather low, not more than 0.3, so this relationship cannot be considered as strong.

According to the **safety** analysis, none of the Member States will reach the 50% reduction in 2010 (P scenario). Some states are approaching the objective (Latvia, France, Portugal), whereas Czech Republic still shows an increase in fatalities. For the 25 EU Member States the overall predicted relative fatalities for

[7] Null scenario: overall 6.8% decrease (2010 versus 2000) of trip time due to changes in transport demand, and faster transport by rail and inland shipping. However, road transport trip time will increase with 9.1% for freight transport and 3.1% for cars.
Full scenario: overall 1.7%, less decrease because of the rail success. This leads to a general increase in rail trip length and therefore trip time in Europe. The road travel time now reduces 3.7% for freight and 0.2% for passengers (2010 compared to 2000).

[8] The reason is that, due to the White Paper, air transport will grow slower and therefore car transport grows faster. This car transport growth slows down again in 2020, when social marginal cost pricing is introduced.

this scenario is 73%. In case of a full implementation of the White Paper it is estimated that the EU as a whole the objective will be reached in 2010. However, in this scenario a rather rigorous implementation of (among other things) e-safety is assumed, which is responsible for a large part of the reduction.

The N scenario predicts a limited increase in EU15 transport **energy consumption** over time, and a strong growth in energy consumption in new Member States[9]. Forecasted energy consumption in the P scenario is somewhat lower than that for the N scenario, and that in the F scenario again is a bit lower than that in the P scenario. The E scenario is the scenario with the lowest transport sector energy consumption. In the EU15, this policy scenario even is predicted to bend the upward trend in energy consumption into a decrease.

If the biofuel policy is excluded from the analysis, the N scenario leads to an almost stable **CO_2 exhaust emission** prediction for the EU15 countries. The stableness of the transport emissions is due to the fact that the transport activity growth will be compensated mainly by increases in the fuel efficiency for all road vehicles, through dieselisation of the fleets as well as through genuine technology improvements. In the new Member States the emissions will increase, due to the much stronger growth in transport activity. Compared to N, the P and F scenario would lead to a very small decrease in CO_2 emissions, due to the biofuel measure. As for energy consumption, CO_2 emissions in the E scenario are significantly lower than those in the other scenarios.

The major driver in all scenarios for the future reduction in **NO_x and particulate emissions** is the introduction of road vehicles complying to the most recent emission standards. For **SO_2 emissions**, this is in first place the introduction of low(er) sulphur fuels in the road transport sector. Overall, there is no significant change in total emissions for these pollutants between the N and P scenario. The F scenario shows a modest decrease in overall emissions compared to the N and P scenarios. Nevertheless, the F scenario shows that an important decrease in rail emissions might be possible by entering the dialogue on environmental improvements with the rail industry. In the E scenario, full implementation of marginal social cost pricing in the freight sector and partial marginal social cost pricing for passenger car and air transport will lead to a further decrease in the emissions. The strong reductions in exhaust emissions for these pollutants, will lead to an increasing importance of well-to-tank emissions. Therefore the predicted percentages reductions in total well-to-wheel emissions are significantly lower than the percentages reductions in exhaust emissions.

It should be recalled that the most effective environmentally actions[10] of the EU, notably effective in reducing CO_2 and pollutant emissions from road vehicles, are outside explicit White Paper measures. They constitute the background developments and context for the different scenarios.

The **noise** exposure and annoyance of the population is set to increase in all scenarios with only relatively minor differences between them. Total road traffic remains about 10 times more annoying than rail transport. The extended scenario gives the lowest increase in the number of people being highly annoyed.

Land take and fragmentation are no White Paper objectives, they however are part of the more general sustainability objective. Both are determined by the infrastructure and the intensity of the infrastructure use. In particular road transport is expected to increase strongly and the traffic pattern to become spatially more spread out. Therefore the use intensity on the whole network is expected to increase, and hence

[9] The 4 new Member States covered by the model TREMOVE, see Annex VII.
[10] E.g. measures affecting vehicle technology as the Euro standards and the ACEA agreement.

fragmentation effects. Their impact will be the worse in regions/countries, the lower the prior use intensity has been or the more confined traffic has been before.

The figures below give an overview of the expected impacts for EU15, NMS10 and EU25.

Table 3: Transport performance in EU25 for the N scenario, relative to 2000(=100), part 1

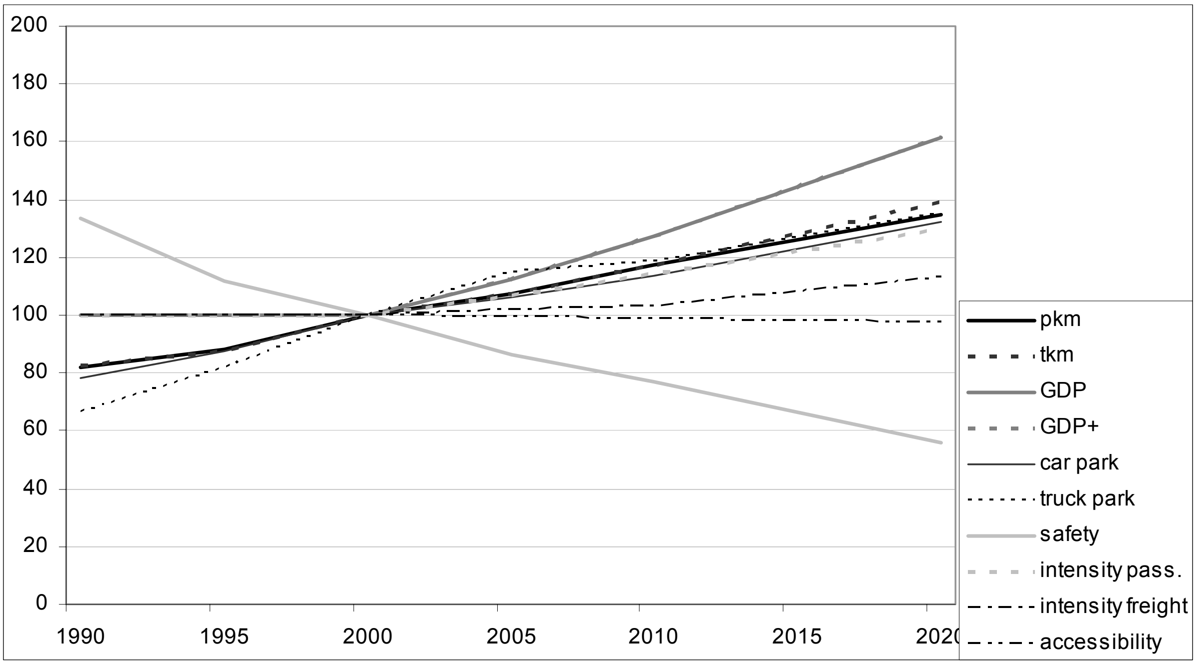


Table 4: Transport performance in EU25 for the N scenario, relative to 2000(=100), part 2

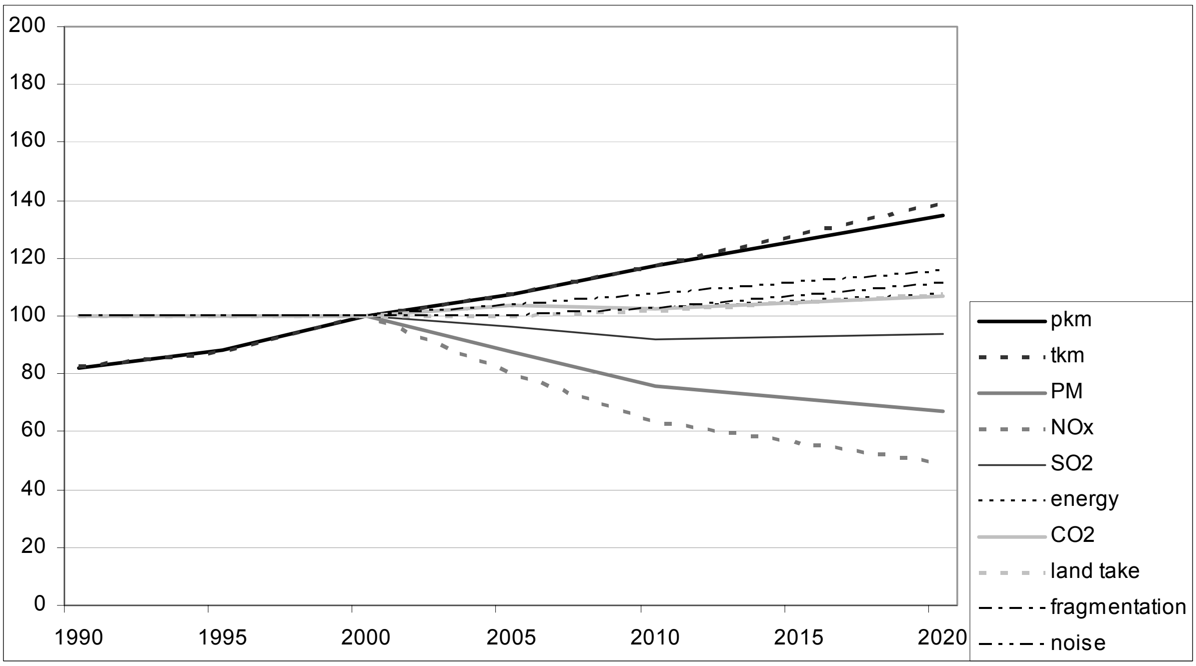


Table 5: Transport performance in EU25 for the P scenario, relative to 2000(=100), part 1

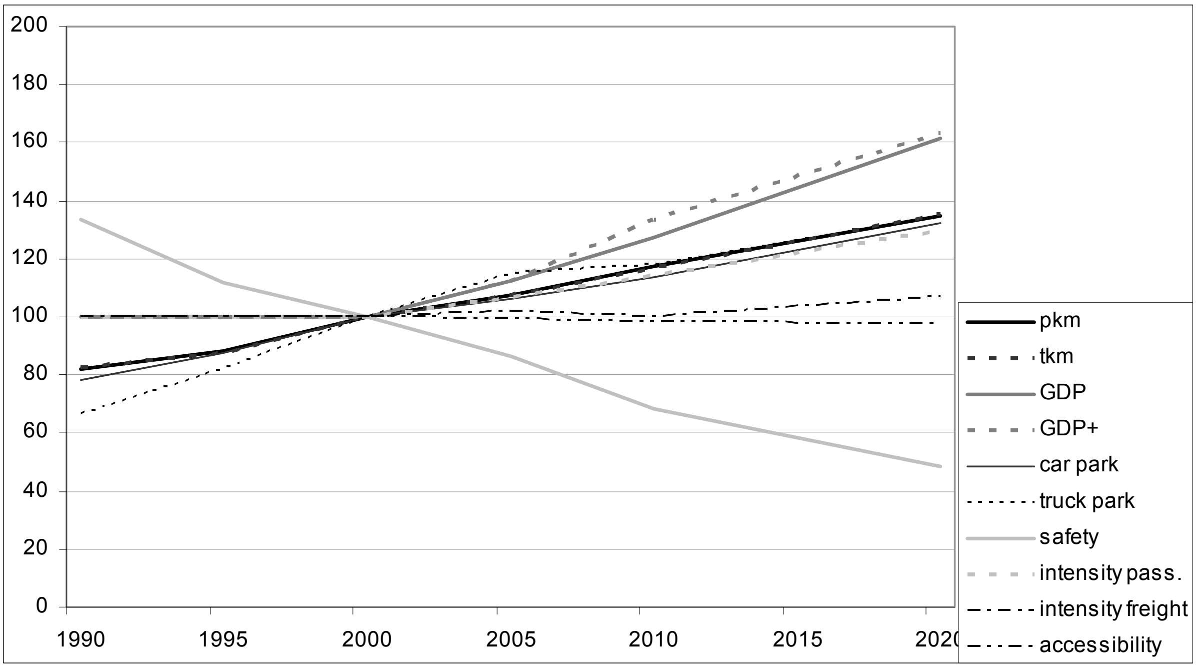


Table 6: Transport performance in EU25 for the P scenario, relative to 2000(=100), part 2

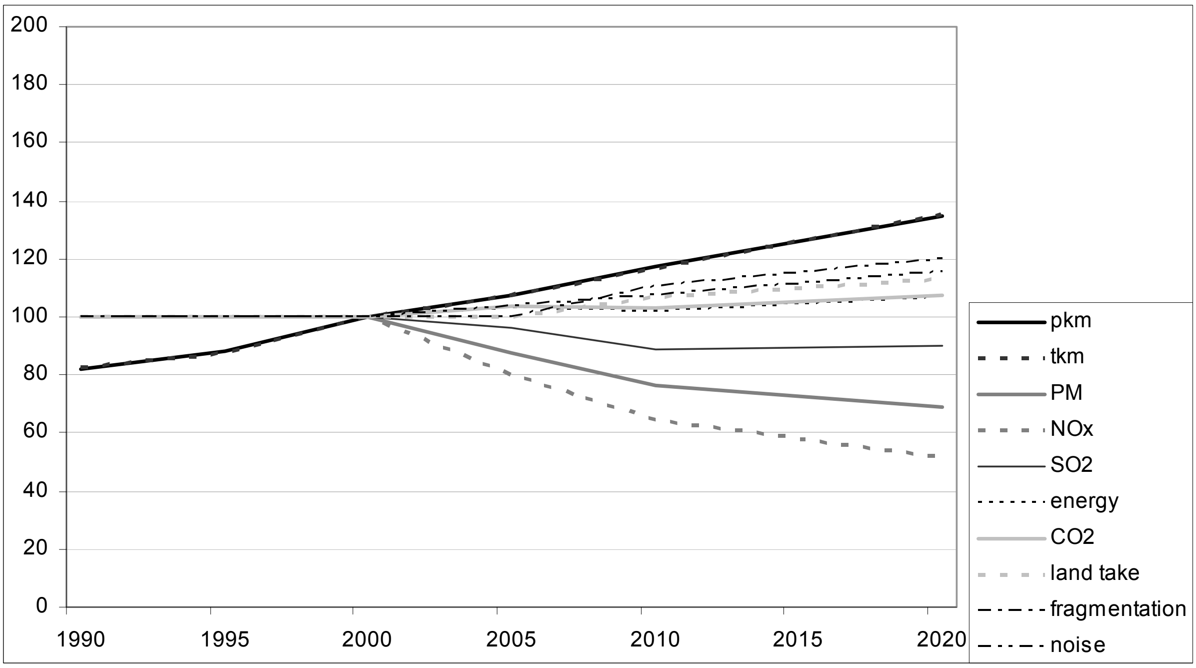


Table 7: Transport performance in EU25 for the F scenario, relative to 2000(=100), part 1

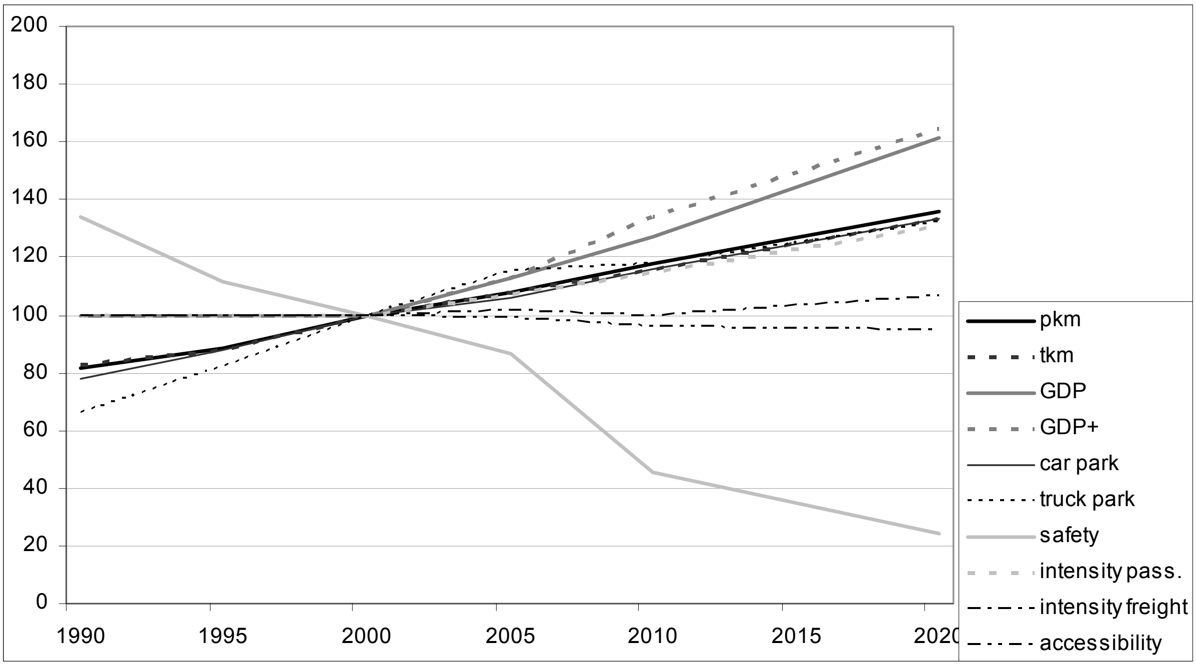


Table 8: Transport performance in EU25 for the F scenario, relative to 2000(=100), part 2

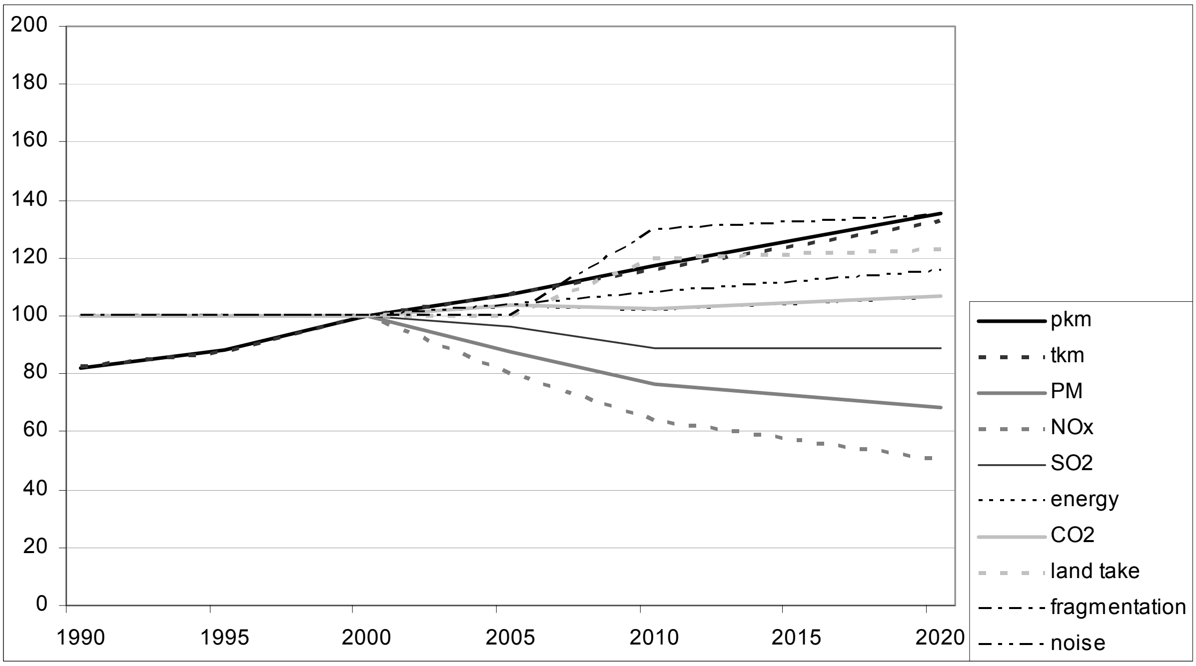


Table 9: Transport performance in EU25 for the E scenario, relative to 2000(=100), part 1

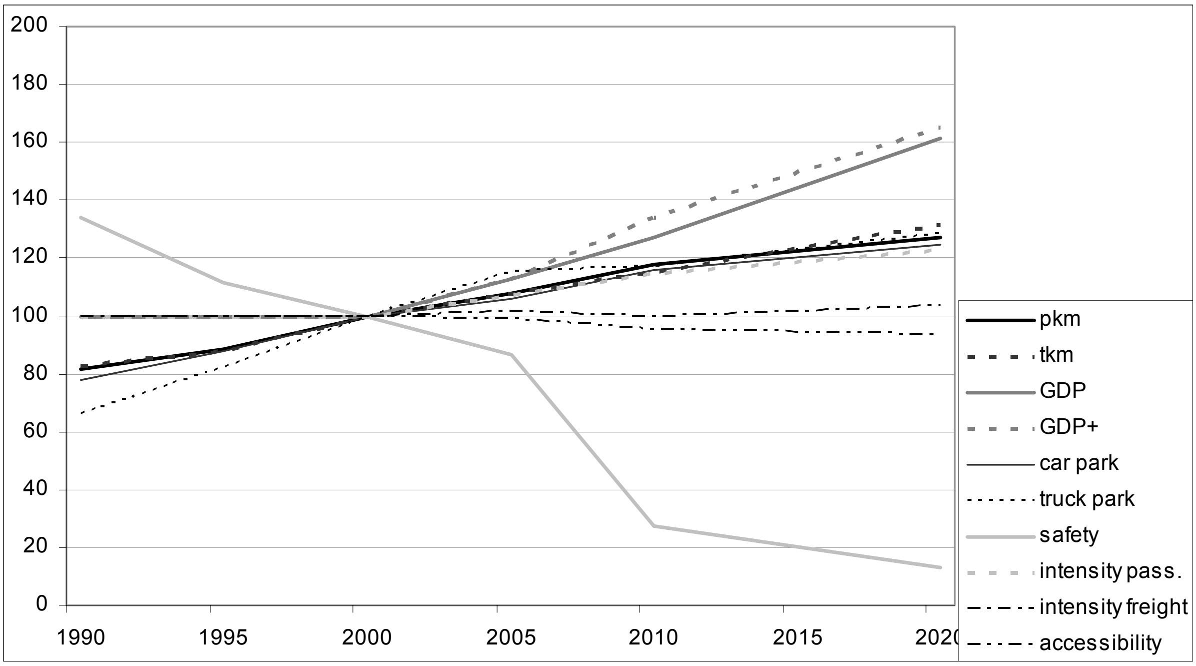
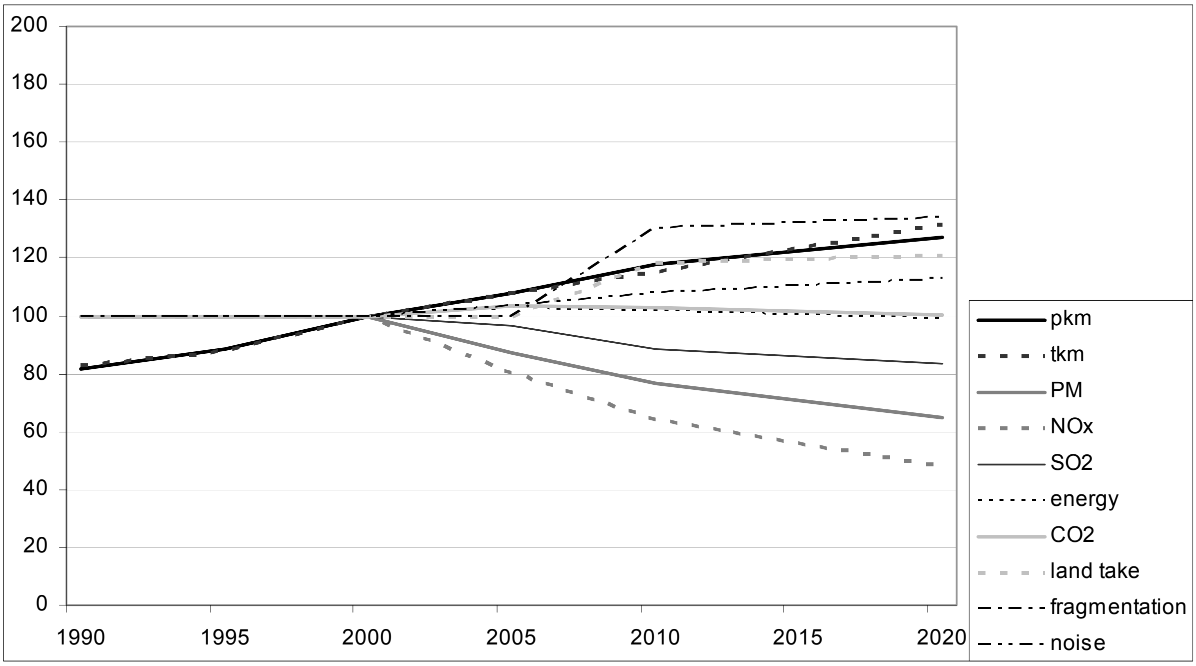


Table 10: Transport performance in EU25 for the E scenario, relative to 2000(=100), part 2



XVII.3. Transport volume

XVII.3.1. An overview of recent developments

The transport situation up to now has been analysed through using up to date, published statistics and complementary information that can be gathered within this project.

All main sources and recent studies published by the European Commission and other international agencies have been used to assemble the statistical information. For key data items, the national sources as well as Eurostat have been consulted, where the published statistics are incomplete or appear problematic. Currently, the Eurostat and DG TREN sources report statistics up to 2003/2004.

As expected in the White Paper, the rate of growth of road freight transport is stronger than growth in car passenger travel for the EU25 as a whole during the period 2001-2005. Total road freight grew from 1507 billion tonne-km in 2001 to 1622 billion in 2005, at an annual average rate of 1.9%. Total passenger car travel grew from 4348 billion passenger-km in 2001 to 4622 billion in 2005, at an annual average rate of 1.5%.

The past trend of an unequal growth in the different modes of transport appears to be continuing to some extent, despite local successes in modal shift in some urban areas in the Member States. Within inland transport, the road share of the freight market has increased from 75.5% in 2001 to 76.3% in 2005 in the EU25. Rail's share of tonne-km is approximately the same in both years at 17.9% and 17.8% respectively, though this is misleading because in 2001 rail freight was declining (reaching a minimum of 17.5% in 2002) and in 2004 figures it has regaining share in the EU15.

For passenger transport, car passenger km accounts for 75.5% of all inland modes in 2001, and for 75.7% in 2005. Bus and coach share declined from 8.4% to 8.0%, whilst rail share declined from 6.0% to 5.8%.

The increase of car and truck demand is expected to worsen the congestion of road traffic already reviewed in the White Paper, particularly in the vicinity of the urban and metropolitan areas in the economically developed regions. The overall decline in rail and bus travel in passenger-kms masks an uneven pattern of development. In some urban areas initiatives that aim to promote public transport have achieved significant modal shifts towards bus or rail. On key commuting corridors the demand for medium to long distance rail services has been increasing in some countries. Bottlenecks therefore exist not only on road but also on some rail corridors. Enlargement has also brought about strong increase in travel demand in the new Member States.

Although the overall freight tonne-km appear to be growing faster than the rate of GDP growth, freight tonne-km in some countries (notably the UK) has been slowing. A complex set of circumstances may be responsible for the slowing down of tonne-km growth, particularly on road. The growth in the service sector, and the decline and off-shoring in the manufacturing sector could be an underlying factor. Furthermore, changes in the logistics sector, such as the possible diminishing expansions of the supply chains and warehousing centralization, and rising fuel costs, could also have contributed to the slowing down.

Table 11: Passenger-km by mode (billion)

Country	Mode	1993	1995	2000	2001	2002
EU25	Passenger Cars	3363.62	3838.10	4241.89	4348.14	4451.33
	Powered Two-wheelers	81.32	126.84	148.00	152.50	156.71
	Buses and Coaches	459.91	459.03	478.30	481.04	484.60
	Tram and metro	42.76	50.78	56.34	57.27	57.32
	Railways	323.06	318.02	345.65	347.38	349.82
	Air transport	0.00	201.50	283.61	286.26	293.65
	Inland Waterways	:	39.10	35.60	51.00	57.10
	All (except unknown)	4390.04	5033.37	5589.40	5723.58	5850.54

Table 12: Tonne-km by mode (billion)

Country	Mode	1993	1995	2000	2001	2002	2003
EU25	Road	0.00	111.70	1475.09	1506.70	1544.32	1556.02
	Railways	342.10	359.42	373.99	357.55	353.86	358.91
	Inland waterways	109.21	119.85	131.88	130.50	129.50	119.49
	All (except unknown)	451.31	590.97	1980.96	1994.75	2027.68	2034.41

XVII.3.2. Summary of model results by scenario

The SCENES model is a European-wide multi-modal integrated passenger and freight transport model. SCENES uses standard European nomenclature and NUTS 2003 GIS data to define the geographic areas. For the purpose of this project, all new Member States are incorporated within the model as internal zones. The base year of SCENES has been updated from 1995 to 2000. This means that all main input data underpinning the base year modelling have been up-dated accordingly, including the national accounts and the associated input-output tables (for EU15), population size and profiles, and transport networks and road vehicle operating costs. The model provides transport demand forecasts for both 2010 and 2020, based on a set of macro-economic and trade assumptions derived from DG TREN's GDP forecasts, and road vehicle operating costs derived from recent fuel price assumptions for 2010 and 2020 (see Annex V and VI for further discussions).

The freight demand model for the EU15 countries is based on a sophisticated regional economic model using spatial input-output techniques, whereas for the EU10 the freight demand matrices are estimated using DG-TREN's TEN-STAC study (TEN-STAC, 2004) and Eurostat's COMEXT trade matrices.

The passenger demand model uses a uniform trip generation and distribution mechanism for all EU25, within which the travel demand is estimated according to the age, employment and car ownership profiles of the population of each model zone; it covers all short and long passenger trips, including walking and cycling.

The SCENES forecasts have been made at the broad geographic and demand segment levels as defined by the zoning and transport demand segmentation adopted in the model (See Annex VI). As a result, they should be considered as forecasts at the strategic level, rather than embodying detailed transport operations at the local level. Compared with earlier demand forecasts (such as TEN-STAC), the ASSESS Project has made use of more recent GDP projections (which are lower than previous ones), and its demand forecasting has benefited from a longer time series of freight demand observations up to 2003/04. As with any model results, the transport demand growths forecast by SCENES are subject to a degree of uncertainty. This uncertainty has been analysed for the key scenario using sensitivity tests.

XVII.3.3. Scenarios

For 2010 and 2020, four scenarios have been run as specified by the project. They are the 'Null', 'Partial', 'Full' and 'Extended'. In particular, the 'Partial' scenario has been tested through two alternative sets of model assumptions on pricing and freight logistic trends in order to examine the possible variations in demand growth. These are denotes 'Partial A' and 'Partial B'.

The model test results are summarised below for each scenario. Where appropriate, we also highlight any weaknesses and uncertainties in the results. For details of model development and scenario test results, see Annex VI.

XVII.3.3.1. The Null scenario

The Null scenario represents a contra-factual situation in which of no White Paper policy measures had been applied. In the absence of the White Paper policy measures, the transport situation is assumed to follow the recently observed trend since the late 1990s. Road congestion would worsen around a number of metropolitan areas. Road building would continue, e.g. in EU10. Road freight haulage costs may fall in some areas because of labour costs, whilst rail freight services would be constrained by supply limitations. There would be continuing changes in freight logistics and land use which would in many cases favour road freight.

In order to represent these changes, the model parameters have been adjusted so that the modelled growth trajectories for 2010 and 2020 reflect the observed trend between the late 1990s and 2003/2004, which represents the period prior to the application of the White Paper measures. These model adjustments are then applied equally to all four scenario tests so that they are compared on a consistent basis. Given that there would be compensating changes in the costs and travel times over time under the Null scenario, it is assumed for simplicity that the input transport cost functions and average speeds on network links are the same as for the 2000 model run.

a. Freight transport demand

The table below presents for the Null scenario the SCENES results for percentage change in freight transport demand among inland transport modes for the time periods between 2000 and 2010, and 2000 and 2020..

Table 13: Null scenario – Freight transport demand, billion tonne-km per year

Region	Mode	observed 2000	Null scenario 2010	Null scenario 2020	% change over period 2000-2010	% change over period 2000-2020
EU15	Road	1319	1553	1873	18%	42%
	Rail	250	240	240	-4%	-4%
	Inland waterway	127	138	155	9%	22%
	All	**1696**	**1931**	**2268**	**14%**	**34%**
NMS10	Road	175	291	405	66%	131%
	Rail	124	117	111	-6%	-11%
	Inland waterway	4	4	4	-3%	3%
	All	**304**	**412**	**520**	**36%**	**71%**
EU25	Road	1495	1844	2278	23%	52%
	Rail	374	357	351	-5%	-6%
	Inland waterway	131	142	159	8%	21%
	All	**2000**	**2343**	**2788**	**17%**	**39%**

SCENES suggests that, among the inland transport modes, road freight would grow strongly. In the EU25, the growth rates from 2000 to 2010 and from 2000 to 2020 are respectively 23% and 52%. In EU15, the growths are slower, albeit from a high base: the road freight growth rates are 18% and 42% respectively for 2010 and 2020. In the EU10, road freight is expected to have much stronger growth, of 66% and 131% respectively for 2010 and 2020.

Rail freight declines in general, whilst inland waterway gains a modest growth in some countries mainly for lower value, bulk goods.

Compared with the SCENES forecasts prior to the ASSESS project, the current freight demand forecast for the Null scenario is lower for road and inland waterways, and there is a slightly sharper decline in rail freight t-km. First of all, this reflects a generally lower GDP growth assumptions (the GDP growth in EU15 is about 0.5% lower per year than assumed by the earlier SCENES runs, although there are some variations between countries). Lower GDP growth implies lower rates of growth in the production and consumption of goods, and in the imports of raw materials and the exports of components and finished products. This then would lead to lower freight demand growth. Secondly, we have assumed that the trend of rail decline in a number of countries, which is observed in the recent years, would continue in the Null scenario in the absence of White Paper policy measures. The GDP and tonne-km forecast is shown in Figure 1 and Figure 2.

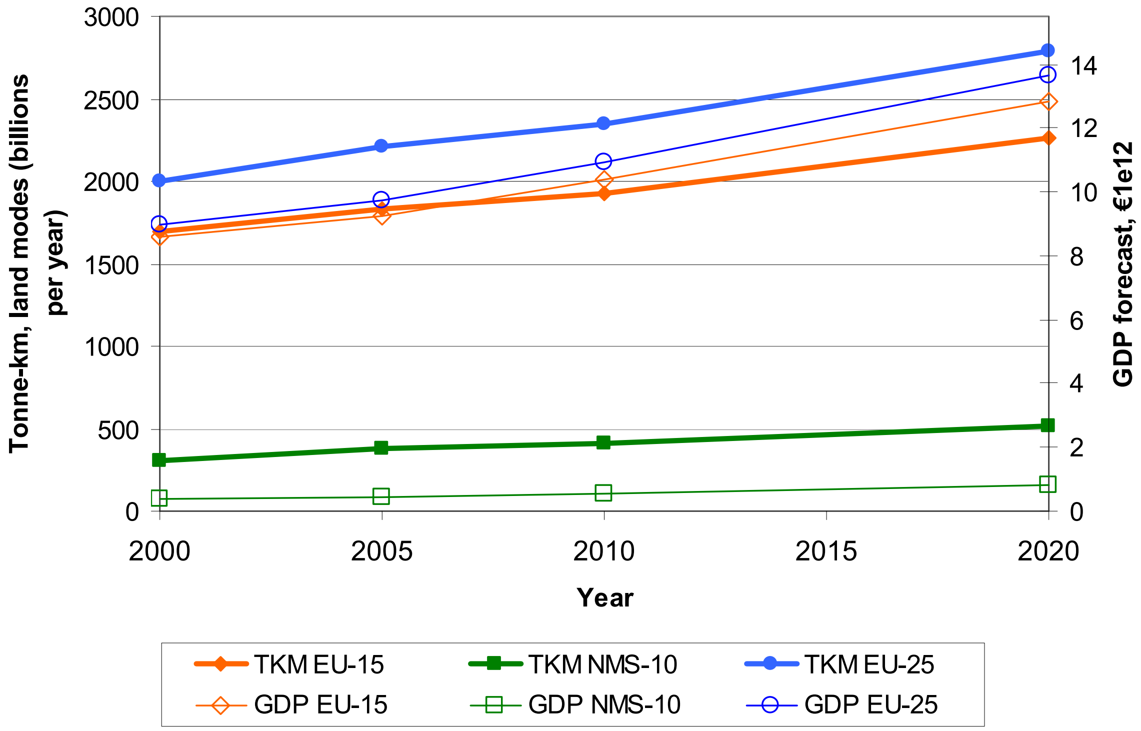


Figure 1: Total tonne-km and GDP in Null scenario trend (road, rail and inland waterway)

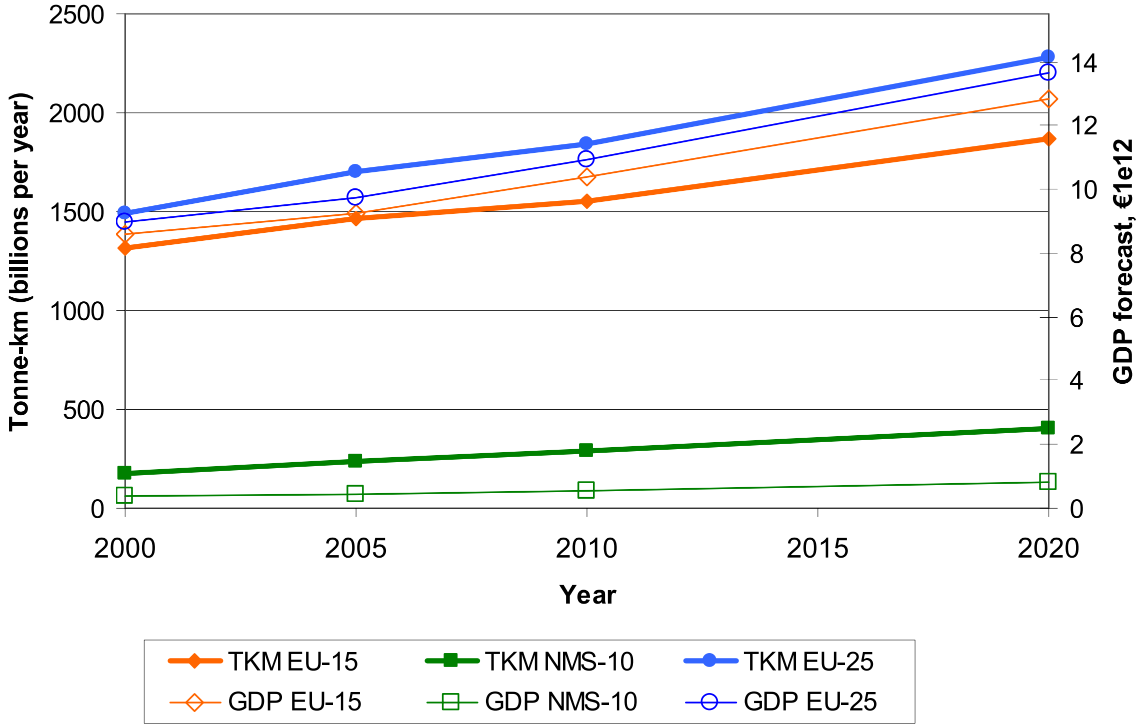


Figure 2: Road freight tonne-km and GDP in Null scenario trend

b. Passenger transport demand

The table below presents the SCENES results for the Null scenario in terms of passenger travel growth from 2000 to 2010 2020.

Table 14: Null scenario – Passenger travel demand, billion passenger-km per year

Region	Mode	observed 2000	Null scenario 2010	Null scenario 2020	% change over period 2000-2010	% change over period 2000-2020
EU15	Car	4094	4706	5393	15%	32%
	Bus/coach	402	423	413	5%	3%
	Train/metro	351	392	416	12%	19%
	Air	284	428	579	51%	104%
	Walk/cycle	215	244	257	13%	19%
	All	**5345**	**6193**	**7058**	**16%**	**32%**
NMS10	Car	325	468	608	44%	87%
	Bus/coach	78	73	67	-7%	-15%
	Train/metro	51	50	48	-4%	-7%
	Air	14	23	34	62%	134%
	Walk/cycle	19	23	24	19%	29%
	All	**488**	**636**	**781**	**30%**	**60%**
EU25	Car	4419	5175	6002	17%	36%
	Bus/coach	480	495	480	3%	0%
	Train/metro	403	442	464	10%	15%
	Air	298	451	612	51%	105%
	Walk/cycle	234	266	281	14%	20%
	All	**5833**	**6829**	**7839**	**17%**	**34%**

Based on the assumptions of population and car ownership growth, and the characteristics of each passenger demand segment, the SCENES model suggests that, in EU25, the total passenger travel demand (in passenger km) will grow by 17% by 2010 and 34% by 2020. This overall growth is characterised by slower percentage rises in EU15 (by 16% and 32% respectively for the period between 2000 and 2010, and 2000 and 2020) and much faster increases in the EU10 new Member States (30% and 60% respectively). Over this period, the population is stable in EU15 and slightly declining in some EU10 countries, so the growth of passenger demand stems mainly from the increasing mobility of the individuals. Within each geographic area, the growth rates are also quite distinct between different demand segments, with long distance holiday and business travel growing more strongly than shorter distance travel like commuting, education and personal business. This has significant implications for growths on different modes.

Under the Null scenario, the modes that see significant demand growths would be car (17% and 36% respectively for 2010 and 2020, in EU25) and air (51% and 105% respectively for 2010 and 2020, in EU25). Train, bus and walking/cycling are expected to grow more slowly in terms of passenger-km. Passenger train/metro/tram services may still rise in some countries, especially in those where commuting and other journeys have been getting longer but road congestion has constrained the growth of peak time road travel. In EU10, bus and train demand is likely to decline.

XVII.3.3.2. The Partial scenario

Two variants of the partial scenario were tested: Partial A implements a small fraction of SMCP tolling for all freight modes, while Partial B charges road freight for motorway use only based on a projection of current national motorway tolls and the Eurovignette. Besides differences in road charging, the A and B scenarios are also based on different assumptions regarding freight growth trends. Scenario details can be found in Annex V and VI. In these scenarios, a number of improvements are made to rail, shipping and inter-modal services, albeit at a modest scale, in terms of transit time changes and service quality improvements.

There is little change in passenger travel costs and times under either scenario, and the passenger results from scenarios A and B are effectively identical.

Under the Partial A Scenario, road freight costs rise by 18% on average in 2010 relative to those in 2000, and by 20% in 2020. Partial B has assumed largely the continuing development of the current truck tolls and on average the level of road freight costs is lower.

a. Freight demand

This section will discuss the Partial scenarios. The comparison of two scenarios should only be made bearing in mind the differences in their input assumptions.

Compared with the Null scenario, the policies implemented under the Partial A scenario lead to a lower rate of growth in road freight demand. Compared with 2000, the road freight growth rates are respectively 21% and 43% for 2010 and 2020 in EU25. Compared with the Null, this is 2% lower by 2010 and 6% lower by 2020. Given that the road costs are 18% higher than in Null in 2010, and 20% higher in 2020, the average demand elasticity with respect to price changes is around 0.1 for 2010 and 0.3 for 2020. These are in line with the expected magnitudes of changes: the measures that lead to the road cost increases (including driving restrictions on heavy goods vehicles on designated roads, driver training and social harmonisation of road transport) are still in the process of being implemented. Thus by 2010 the transport system will have only a very short period to adjust. That is why that demand changes are more modest by 2010 compared with the Null. However, by 2020, the impact of these cost changes are likely to lead to larger impacts.

Table 15: Partial scenarios – Freight transport demand, billion tonne-km per year

Region	Mode	Observed 2000	Partial A scenario 2010	2020	% change over period 2000-2010	2000-2020
EU15	Road	1319	1523	1753	15%	33%
	Rail	250	254	273	2%	9%
	Inland waterway	127	139	157	9%	24%
	All	**1696**	**1916**	**2183**	**13%**	**29%**
NMS10	Road	175	280	387	60%	120%
	Rail	124	130	142	5%	14%
	Inland waterway	4	4	5	-1%	7%
	All	**304**	**415**	**533**	**36%**	**75%**
EU25	Road	1495	1803	2139	21%	43%
	Rail	374	384	414	3%	11%
	Inland waterway	131	143	162	9%	23%
	All	**2000**	**2331**	**2715**	**17%**	**36%**

Region	Mode	Observed 2000	Partial B scenario 2010	2020	% change over period 2000-2010	2000-2020
EU15	Road	1319	1 588	1 907	20%	45%
	Rail	250	269	280	8%	12%
	Inland waterway	127	141	164	11%	29%
	All	**1696**	**1 998**	**2 352**	**18%**	**39%**
NMS10	Road	175	298	411	70%	134%
	Rail	124	134	142	8%	14%
	Inland waterway	4	4	4	0%	6%
	All	**304**	**437**	**558**	**44%**	**83%**
EU25	Road	1495	1 886	2 318	26%	55%
	Rail	374	403	422	8%	13%
	Inland waterway	131	146	169	11%	28%
	All	**2000**	**2 435**	**2 909**	**22%**	**45%**

As a result of road cost increases, and the improvements on rail, shipping and inter-modal transport, rail freight is expected to grow by a modest amount (3% by 2010 and 11% by 2020 in EU25). [Shipping growth for Partial A to be confirmed]

Under the Partial B scenario, the overall freight demand growth for inland modes tonne-kilometres is likely to be 22% for the period 2000-2010, and 45% for 2000-2020. The road tonne-km growth is likely to be 26% for 2000-2010, and 55% for 2000-2020. Rail tonne-km growth is to be 8% for 2000-2010, and 13% for 2000-2020. Short sea shipping demand, when measured in tonnes received at the ports, is likely to grow by 16 and 36% respectively for 2010 and 2020.

In other words, the policy measures under the Partial scenarios are likely to halt the decline of rail freight, but they would not be sufficient to achieve the target of retaining the modal split pattern of 1998.

b. Passenger demand

When the Partial scenario is compared with the Null scenario, overall passenger demand does not appear to be significantly different. The improvements in rail services under the Part scenario have led to a modest gain in passenger train demand.

Table 16: Partial scenario – Passenger travel demand, billion passenger-km per year

Region	Mode	observed 2000	Partial scenario 2010	Partial scenario 2020	% change over period 2000-2010	% change over period 2000-2020
EU15	Car	4094	4704	5388	15%	32%
	Bus/coach	402	422	413	5%	3%
	Train/metro	351	398	429	13%	22%
	Air	284	427	586	50%	106%
	Walk/cycle	215	244	256	13%	19%
	All	**5345**	**6195**	**7071**	**16%**	**32%**
NMS10	Car	325	468	607	44%	87%
	Bus/coach	78	73	66	-7%	-15%
	Train/metro	51	50	49	-2%	-4%
	Air	14	23	34	61%	136%
	Walk/cycle	19	23	24	19%	29%
	All	**488**	**637**	**781**	**30%**	**60%**
EU25	Car	4419	5172	5995	17%	36%
	Bus/coach	480	495	479	3%	0%
	Train/metro	403	449	479	11%	19%
	Air	298	450	619	51%	108%
	Walk/cycle	234	266	281	14%	20%
	All	**5833**	**6832**	**7852**	**17%**	**35%**

XVII.3.3.3. The Full Scenario

Under the Full scenario, the road freight costs rise further as a result of a limited application of Social Marginal Cost Pricing (SMCP). The average road costs rise by 20% overall (including those measures already included in the Partial scenario) by 2010, and 27% by 2020. The Full scenario includes additional rail freight service improvements in addition to those in the Part scenario, including rail freight transit time and border crossing time reductions, improvements of service reliability, and inter-modal service enhancements.

On passenger modes, there are a range of measures that improve bus and train services. Average car speeds are increased as a result of better traffic management that is supported by the Galileo programme. On air, the application of VAT to air fares increases the price of air travel by 7%.

a. Freight demand

Under the Full scenario, the SMCP is applied for trucks in all Member States. This appears to have a significant impact on the modal balance between road on the one hand, and rail and inland waterway on the other. Compared with 2000, road demand rises by 19% under the Full scenario, compared with 21% under Partial in 2010. For 2020, the difference between the Partial and the Full scenarios are even larger for road freight demand: under the Full scenario it is 38% relative to 2000, compared with 43% under Partial, for EU25. Rail freight tonne-kms have a much stronger growth across the EU25, by 8% in 2010 and 19% in 2020, relative to the year 2000.

However, the road and rail percentages indicate that only a limited proportion of the freight tonne-kms are transferred from road to rail under SMCP. The tests by the model suggest that a significant proportion of road freight demand reduction is through a shortening of the average lengths of road haulage. In other words, only a limited range of goods (such as the weighty goods like bulk building materials, metals, and some chemical products, plus certain long distance movements of containers from sea ports) can be transferable from road to rail. For the other products, particularly the volumenous goods such as food and finished consumer products, the road demand reduction is likely to result mainly from an adjustment in the geographic patterns of sourcing. That is, the goods required by consumers will be provided by suppliers from within a shorter distance range relative to the Partial scenario.

Table 17: Full scenario – Freight transport demand, billion tonne-km per year

Region	Mode	observed 2000	Full scenario 2010	Full scenario 2020	% change over period 2000-2010	% change over period 2000-2020
EU15	Road	1319	1503	1690	14%	28%
	Rail	250	261	299	5%	20%
	Inland waterway	127	140	158	10%	24%
	All	**1696**	**1904**	**2147**	**12%**	**27%**
NMS10	Road	175	268	365	53%	108%
	Rail	124	143	148	15%	19%
	Inland waterway	4	4	5	0%	8%
	All	**304**	**415**	**518**	**37%**	**70%**
EU25	Road	1495	1771	2056	19%	38%
	Rail	374	404	446	8%	19%
	Inland waterway	131	144	163	10%	24%
	All	**2000**	**2319**	**2665**	**16%**	**33%**

b. Freight demand, internal market, and economic growth

Compared with road traffic growth, the growth in rail freight demand under the Full scenario would seem modest. This in part stems from the fact that the evolution of the European economy in the next two decades is likely to erode further the traditional base of rail freight market, such as the bulk products used as raw materials for manufacturing. This indicates that it would be necessary for the rail freight operators to adapt to the changes in the commodities mix, and to win new customers through improving reliability, responsiveness and general quality of service. Furthermore each country should enable and support the interconnectivity and interoperability of national networks as well as the access to such networks. This will help to develop new markets in the medium to long distance transport of finished products and components, e.g. to and from the sea ports and major manufacturing and distribution sites. The realisation of this potential for rail freight development could contribute significantly to the broadening of the catchment for both producers and consumers in the internal market, support the GDP growth of the Member States, and reinforce the trade ties between different regions within the EU, whilst maintaining the long term environmental sustainability of freight transport.

c. Passenger demand

The most significant input for passenger demand is the imposition of a harmonised 7% VAT on air travel. As a result of this taxation, air passenger demand is likely to grow more slowly than in the Null and Partial scenarios. Nonetheless, air passenger demand will still rise significantly, particularly in the longer term: compared with the Null scenario, the air passenger demand growth rate for 2010 is dampened from a raise of 51% (N) to 34% (F) in 2010, and from 105% to 95% in 2020.

Table 18: Full scenario – Passenger travel demand, billion passenger-km per year

Region	Mode	observed 2000	Full scenario 2010	Full scenario 2020	% change over period 2000-2010	% change over period 2000-2020
EU15	Car	4094	4768	5453	16%	33%
	Bus/coach	402	429	428	7%	7%
	Train/metro	351	399	432	13%	23%
	Air	284	377	548	33%	93%
	Walk/cycle	215	241	252	12%	17%
	All	**5345**	**6213**	**7113**	**16%**	**33%**
NMS10	Car	325	472	612	45%	88%
	Bus/coach	78	73	68	-7%	-13%
	Train/metro	51	51	50	-1%	-3%
	Air	14	22	32	52%	126%
	Walk/cycle	19	22	24	18%	28%
	All	**488**	**640**	**786**	**31%**	**61%**

Region	Mode	observed	Full scenario		% change over period	
		2000	2010	2020	2000-2010	2000-2020
EU25	Car	4419	5240	6064	19%	37%
	Bus/coach	480	502	496	5%	3%
	Train/metro	403	449	482	12%	20%
	Air	298	399	580	34%	95%
	Walk/cycle	234	264	276	13%	18%
	All	**5833**	**6853**	**7899**	**17%**	**35%**

The policy measures to encourage public transport (i.e. bus and rail modes) have led to a further increase in its travel demand. The Full scenario sees a slightly better modal balance, as well as a slight increase in the overall passenger mobility.

XVII.3.3.4. The Extended Scenario

The extended scenario includes all policy measures put forward in the full scenario. Under this scenario, there is full scale SMCP charging for road freight, and partial scale SMCP for passenger cars and air travel. Moreover, the rail freight services are to improve their quality of services significantly, over and above those assumed under the full scenario.

a. Freight demand

The Tipmac SMCP on trucks is applied fully under the extended scenario (50% by 2010 and 100% by 2020). This causes overall truck operating costs to rise by 27% in 2010, and 40% in 2020. As a result, in EU25 the truck tonne-kms reduce by 5% by 2010, and 13% by 2020, relative to the Null scenario. The relatively small reduction in road demand by 2010 reflects the fact that road demand adjustments are likely to be limited because of short time horizon, even if such charges are to be introduced right away. The scope of longer term adjustment is indicated by the results for 2020, which implies an average demand elasticity around 0.3.

Under this scenario, rail and inland waterway tonne-km growth rates could come close to that for trucks, for EU25 as a whole. The improvements in rail freight service quality have led to a further increase in rail demand.

Table 19: Extended scenario – Freight transport demand, billion tonne-km per year

Region	Mode	observed	extended scenario		% change over period	
		2000	2010	2020	2000-2010	2000-2020
EU15	Road	1319	1487	1626	13%	23%
	Rail	250	266	329	7%	32%
	Inland waterway	127	141	161	11%	27%
	All	**1696**	**1894**	**2116**	**12%**	**25%**
NMS10	Road	175	262	345	49%	97%
	Rail	124	151	158	21%	27%
	Inland waterway	4	4	5	1%	11%
	All	**304**	**417**	**508**	**37%**	**67%**
EU25	Road	1495	1749	1971	17%	32%
	Rail	374	417	488	12%	30%
	Inland waterway	131	145	166	11%	26%
	All	**2000**	**2312**	**2625**	**16%**	**31%**

b. Passenger demand

For the extended scenario, car operating costs would rise on average by 38% if 1/4 of the Tipmac SMCP values are to be introduced. On air, 1/4 of the Tipmac SMCP values are also introduced, which imply an increase of air fares by 20%. As a result, the car and air demand reduces. Bus, train and walk/cycle modes gain. Overall, this also reduces the passenger mobility by 5% compared with the Null scenario: the total passenger-km grow by 27% in EU25 relative to 2000, compared with the 34% under the Null scenario.

Table 20: Extended scenario – Passenger travel demand, billion passenger-km per year

		observed	extended scenario		% change over period	
Region	**Mode**	**2000**	**2010**	**2020**	**2000-2010**	**2000-2020**
EU15	Car	4094	4772	5018	17%	23%
	Bus/coach	402	431	447	7%	11%
	Train/metro	351	395	461	12%	31%
	Air	284	390	479	37%	69%
	Walk/cycle	215	239	257	11%	20%
	All	**5345**	**6227**	**6662**	**16%**	**25%**
NMS10	Car	325	474	562	46%	73%
	Bus/coach	78	73	72	-6%	-8%
	Train/metro	51	50	58	-3%	12%
	Air	14	22	31	54%	114%
	Walk/cycle	19	22	26	18%	35%
	All	**488**	**642**	**748**	**31%**	**53%**
EU25	Car	4419	5246	5579	19%	26%
	Bus/coach	480	505	519	5%	8%
	Train/metro	403	445	518	11%	29%
	Air	298	412	510	38%	71%
	Walk/cycle	234	262	283	12%	21%
	All	**5833**	**6869**	**7410**	**18%**	**27%**

XVII.3.3.5. Summary of freight scenario results

This section shows the results of the preceding tables in summary graphical form.

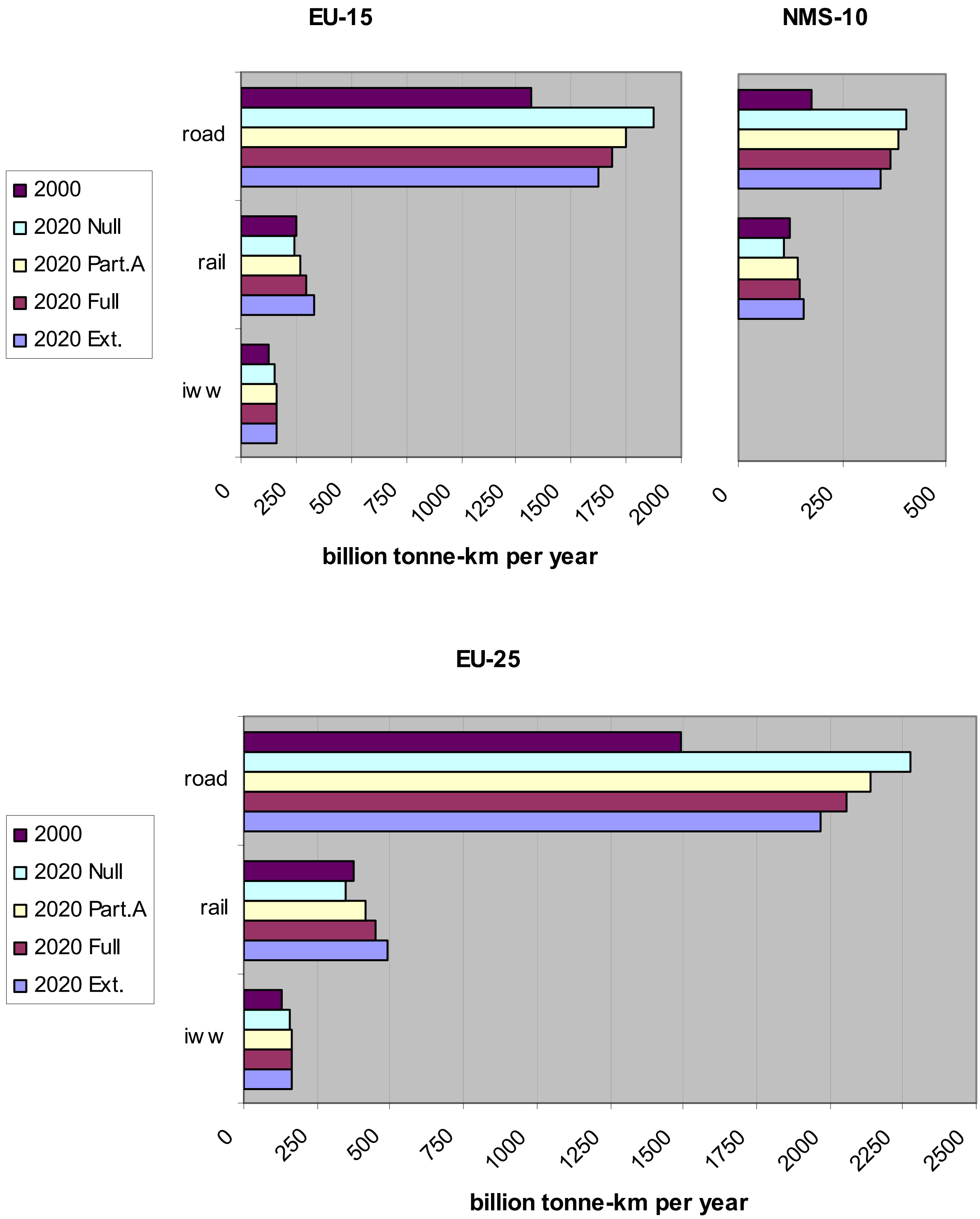


Figure 3: Scenario results by freight mode (tonne-km per year)
"iww" denotes inland waterway.

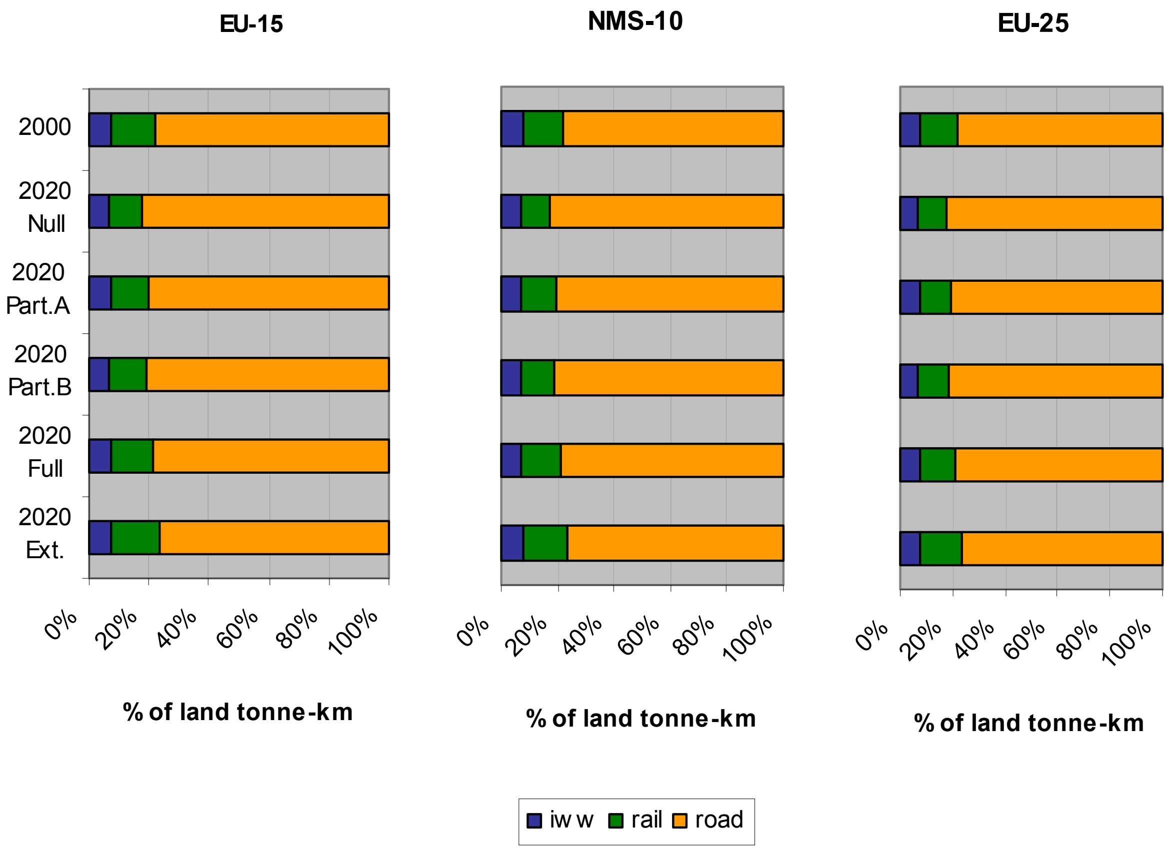


Figure 4: Scenario results, freight mode split by tonne-km

"iww" denotes inland waterway.

XVII.3.3.6. Summary of passenger scenario results

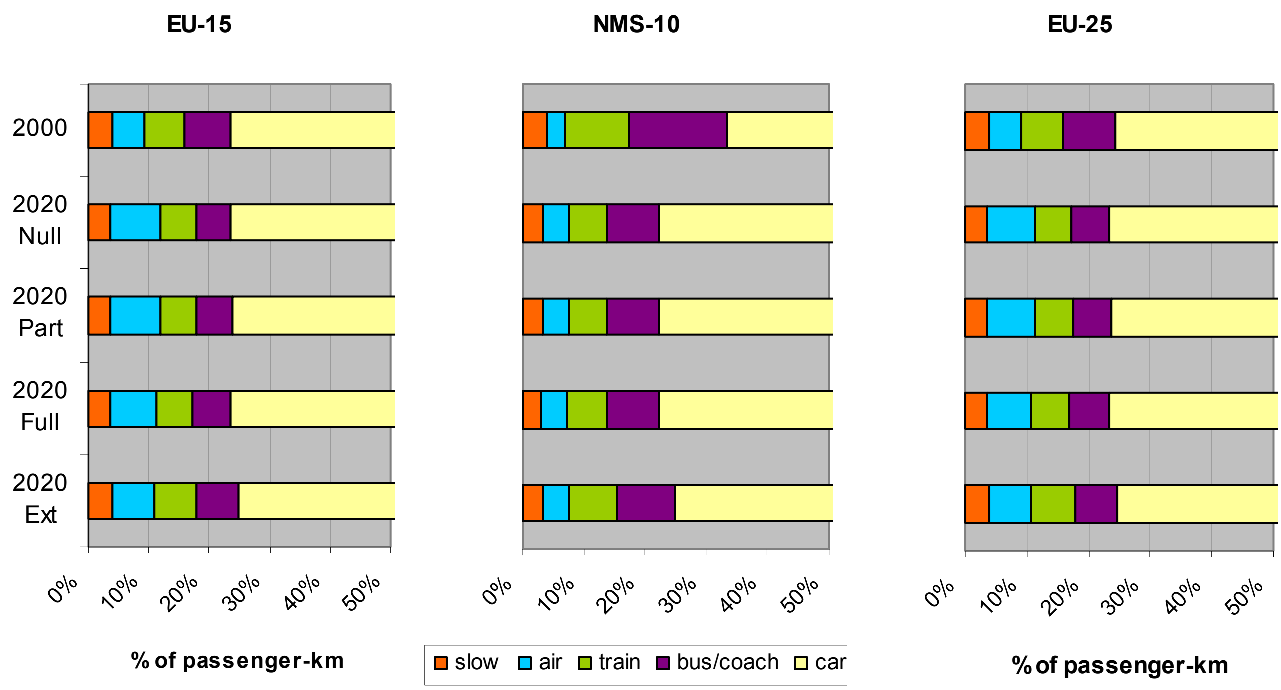


Figure 5: Scenario results, passenger-km mode split

* NOTE AXES FINISH AT 50%

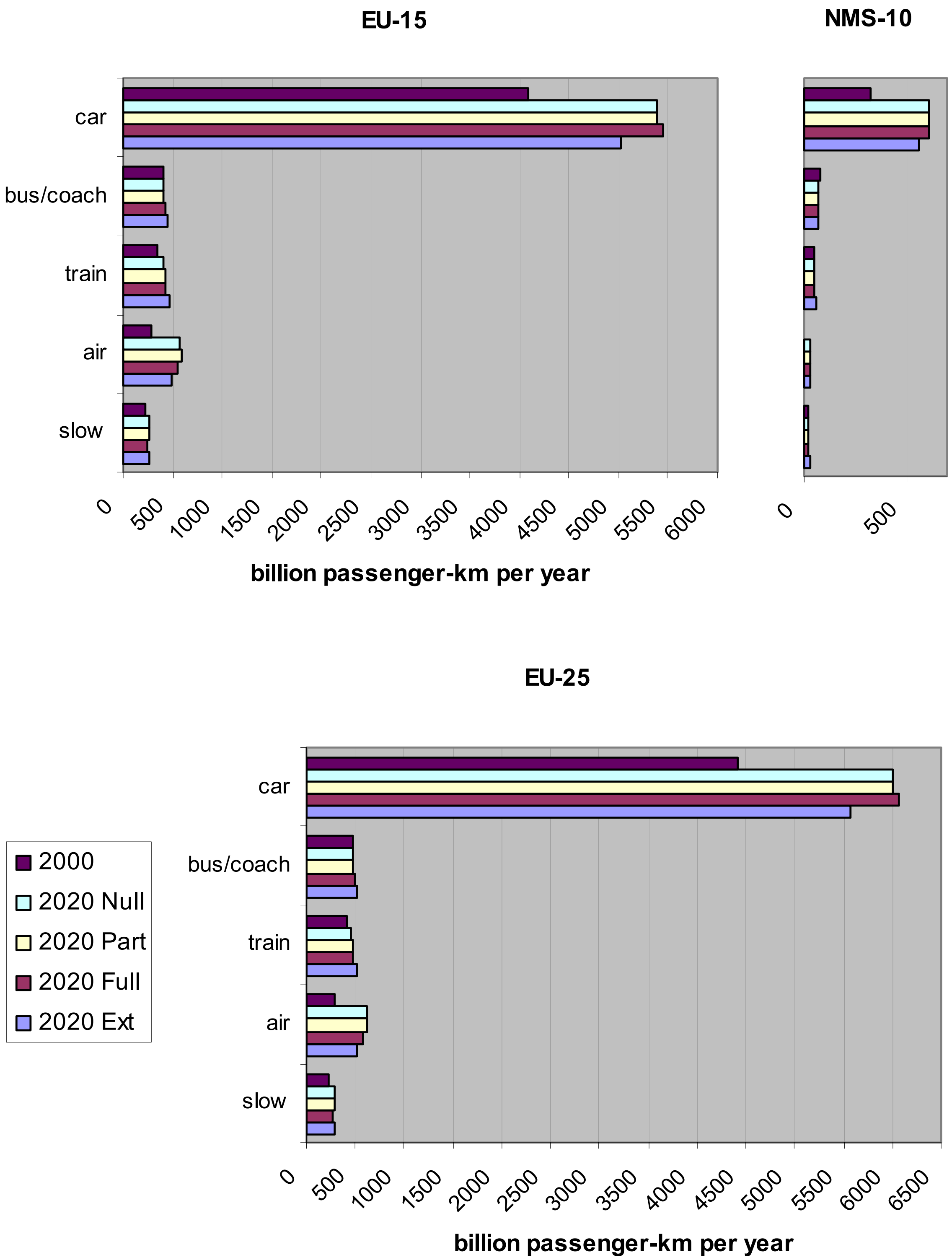


Figure 6: Scenario results by passenger mode (billion passenger-km per year for EU25)

XVII.4. Modal shares

There is a growing imbalance between modes of transport in the European Union. The increasing success of road and air transport is resulting in ever worsening congestion, while, paradoxically, failure to exploit the full potential of rail and short-sea shipping is impeding the development of real alternatives to road haulage. However saturation in certain parts of the European Union must not blind us to the fact that outlying areas have inadequate access to central markets. This persisting situation is leading to an uneven distribution of traffic, generating increasing congestion, particularly on the main trans-European corridors and in towns and cities. Therefore, one of the main objectives of the White Paper is to realise a modal shift from road and air to rail and water.

The modal shares are calculated on the basis of transport volumes as presented in the previous section. They are presented for each transport mode. Whether the objectives of the White Paper are realised is described later on within Section XVII.6. The figures as presented in this section are supportive to the analysis.

XVII.4.1. Modal shares passenger transport

Table 21 shows that market shares of car transport are not changing statistically in the EU15. The same is also the case for slow mode. However, the market shares of bus/coach and train are decreasing in the EU15. It is compensated by an increase of air transport. Within the new Member States, the market share of car transport is increasing significantly. The same is true for air transport. Market shares of environmental modes (bus/coach, train and slow mode) are decreasing.

The implementation of the White Paper measures is not able to stop the fall of market share. In all three policy scenarios the reduction is almost similar to the reference (null scenario). This is due to absence of powerful measures in the White Paper in the area of passenger transport.

Especially in the new Member States the autonomous growth (null scenario) of transport is in favour of car and air transport. The market share of these two modes is raising from 70% up to 77%, in case no White Paper was available. This in contradiction to the EU15, where the market share of car and air transport is only increasing with 1%. There are also differences over countries. The growth of market share of road and air is limited in France (+0.1% autonomous growth), whereas Ireland has an autonomous growth of 3%. The autonomous growth of car and air transport in the new Member States is in line with the average growth. Lithuania has the lowest growth (+5%), whereas Estonia has the highest growth (+9%).

It can be concluded that a modal shift from car and air to rail, bus/coach and slow mode is not feasible with the set of measures proposed. The White Paper misses measures that impact upon the modal choice of passengers.

Table 21: Modal shares passenger transport (unit: % of passenger-km)

		Obs	Null		Partial		Full		Ext	
		2000	**2010**	**2020**	**2010**	**2020**	**2010**	**2020**	**2010**	**2020**
EU15	Car	76.6	76.0	76.4	75.9	76.2	76.7	76.7	76.6	75.6
	Bus/coach	7.5	6.8	5.9	6.8	5.8	6.9	6.0	6.9	6.7
	Train	6.6	6.3	5.9	6.4	6.1	6.4	6.1	6.3	6.9
	Air	5.3	6.9	8.2	6.9	8.3	6.1	7.7	6.3	7.2
	Slow	4.0	3.9	3.6	3.9	3.6	3.9	3.5	3.8	3.9
	Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
NMS10	Car	66.6	73.6	77.9	73.5	77.7	73.7	77.8	73.8	75.1
	Bus/coach	16.0	11.4	8.5	11.4	8.5	11.4	8.6	11.4	9.7
	Train	10.5	7.8	6.1	7.9	6.3	7.9	6.4	7.8	7.7
	Air	2.9	3.7	4.3	3.6	4.3	3.4	4.1	3.4	4.1
	Slow	3.9	3.5	3.1	3.5	3.1	3.5	3.1	3.5	3.4
	Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
EU25	Car	75.7	75.8	76.6	75.7	76.3	76.5	76.8	76.4	75.3
	Bus/coach	8.2	7.3	6.1	7.2	6.1	7.3	6.3	7.3	7.0
	Train	6.9	6.5	5.9	6.6	6.1	6.6	6.1	6.5	7.0
	Air	5.1	6.6	7.8	6.6	7.9	5.8	7.3	6.0	6.9
	Slow	4.0	3.9	3.6	3.9	3.6	3.8	3.5	3.8	3.8
	Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

XVII.4.2. Modal shares freight transport

Table 22 shows that market shares of road freight are increasing significantly in the EU15 in all scenarios. However due to the implementation of the White Paper measures it is possible to reduce the increase of road freight market share with 1.5% compared to the reference (null scenario). If the White Paper was fully implemented the increase of road freight market shares could be reduced with an additional 1.5% compared to the partial scenario. If the extended scenario was implemented it will almost be possible to stop the increase of road freight market share (if compared to the reference).

Rail freight and ship market shares are decreasing in all scenarios within the EU15. Due to the implementation of the White Paper measures the rail freight market share is decreasing with almost 1% and the ship market share is decreasing with more than 1%. However, compared to the reference (Null Scenario) it is possible to compensate the loss of rail freight market share with 0.5% and the ship market share with 1.1%. If the White Paper was fully implemented it was possible to increase the rail freight market share with an additional 0.1% and the ship market share with 1.1%. If the full White Paper was implemented, including the extra measures (extended scenario) it will be possible to increase the rail freight market share with an additional 0.2% and the ship market share with an additional 0.3%, both compared to the full scenario. IWW market shares are not changing significantly within the EU15.

Within the NMS10 the market shares of road freight are increasing rapidly. Compared to the 2000 values, the road freight market share is increasing with 8% due to the implementation of the White Paper measures. However, compared to the reference (Null Scenario), in which no White Paper is implemented, the road freight market share is reduced with almost 3%. If the White Paper was fully implemented, the road freight market shares could be reduced with an additional 2.5% compared to the partial scenario. If the extended scenario was implemented again a reduction of 1.5% road freight market share can be realised (compared to the full scenario). In that case the road freight market share is reduced with almost 4% compared to the partial scenario.

Rail freight market shares are decreasing rapidly within the NMS10. However, due to the implementation of White Paper measures the rail freight market share is increasing with 2% compared to the reference (null scenario). If the White Paper measures were fully implemented an additional increase of 2% could be realised (compared to the partial scenario). If the extend scenario was implemented, the rail freight market shares can increase with more than 3% compared to the partial scenario.

IWW and ship market shares are decreasing, but the decrease is very limited.

It can be concluded, based on the simulation results, that a modal shift from road to rail, inland waterway transport and ship can be realised, if one aims to change the reference development and aims to stabilise market shares at the level of 2000. In such a case the full White Paper or the extended scenario has to be implemented. Increasing the market shares of rail, inland waterway transport and ship is not feasible. None of the policy scenarios is able to improve the market share of the sum of these modes compared to the situation in 2000.

Table 22: Modal shares freight transport (unit: % of tonne-km)

Region	Mode	Obs	Null		Partial A		Partial B		Full		Ext	
		2000	2010	2020	2010	2020	2010	2020	2010	2020	2010	2020
EU15	road	77.8	80.4	82.6	79.5	80.3	79.5	81.1	79.0	78.7	78.5	76.8
	rail	14.7	12.4	10.6	13.3	12.5	13.5	11.9	13.7	13.9	14.1	15.6
	iww	7.5	7.1	6.8	7.2	7.2	7.1	7.0	7.3	7.4	7.4	7.6
	total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
NMS10	road	57.7	70.6	77.9	67.6	72.6	68.3	73.8	64.5	70.6	62.8	67.9
	rail	40.9	28.4	21.3	31.4	26.6	30.7	25.4	34.5	28.5	36.2	31.2
	iww	1.4	1.0	0.8	1.0	0.8	1.0	0.8	1.0	0.9	1.0	0.9
	total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
EU25	road	74.7	78.7	81.7	77.4	78.8	77.5	79.7	76.4	77.1	75.7	75.1
	rail	18.7	15.2	12.6	16.5	15.3	16.6	14.5	17.4	16.8	18.1	18.6
	iww	6.6	6.1	5.7	6.1	6.0	6.0	5.8	6.2	6.1	6.3	6.3
	total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

“iww” denotes inland waterway.

A more specific analysis for the rail freight sector in the new Member States shows that rail still retains over 40% of the freight market in the countries of central and eastern Europe (not including maritime cabotage). On the basis of current trends, this modal share could fall to 30% by 2010. However, the existence of this particularly extensive, dense rail network and of significant know-how is a unique opportunity, which must be seized in order to rebalance the transport modes in an enlarged Europe. Every effort must therefore be made to convince the countries in question of the need to maintain the railways’ share of the freight market at a high level, with a target around 35% for 2010.

The modelling results show that, compared to the reference (the null scenario), the rail freight market share is increasing in the new Member States with 2% due to implementation of White Paper measures (partial scenario). Therefore the White Paper does have a positive impact on rail usage. However, it should be noted that compared to the 2000 figure, the rail freight market share in the reference (null scenario) is decreasing with 8,0%. If the White Paper was fully implemented (full scenario) the rail freight market share was increasing with an additional 2%, up to 4%, compared to the partial scenario. One could realise an additional 3% increase of the market share, up to 5%, if the additional measures are included in the White Paper.

One can conclude that none of the policy scenarios can mitigate the negative trend in rail freight market share values. However, the objective to maintain the rail freight market share in Central and east European countries at a high level with a target around 35% for 2010, is not achieved according to the model results. The results show that the market share of rail is already 28% in 2000. However, the preferred drop of one eighth is realised in the full and extended scenarios. The loss of market share, compared to the 2000 (reference) figure, is highest in Poland (-12%). Slovakia has the lowest loss (-0.4%).

The White Paper objectives have in some countries a positive impact on the rail freight market share. Slovakia realises a rail freight market share that is the same as it is calculated for the base year 2000 if the White Paper was fully implemented (full scenario). If the extended scenario was implemented, it can be concluded that also Estonia, Latvia, and Lithuania realise a rail freight market share that is higher that it was in 2000 (see also Table 23).

Country	Reference (Null Scenario 2010 compared to 2000)	Impact policy scenarios compared to reference development		
		Partial	Full	Ext
CZ	-10.8	+1.1	+4.0	+4.4
EE	-4.4	+1.2	+4.3	+4.6
HU	-5.1	+1.0	+2.1	+2.9
LV	-4.7	+0.9	+3.0	+4.7
LT	-4.3	+1.2	+3.3	+4.6
PL	-11.6	+3.6	+5.6	+7.5
SK	-8.3	+0.5	+1.3	+1.6
SI	-0.4	+0.3	+0.4	+0.6

Table 23: Modal share rail (%)

Whereas there is a significant drop of rail freight market share in the central and eastern European countries, it can be concluded that there is only a small drop in the EU15 (at maximum 4%; France). However, the impact of the White Paper measures is much lower (probably as most rail freight measures are focussing on central and eastern Europe).

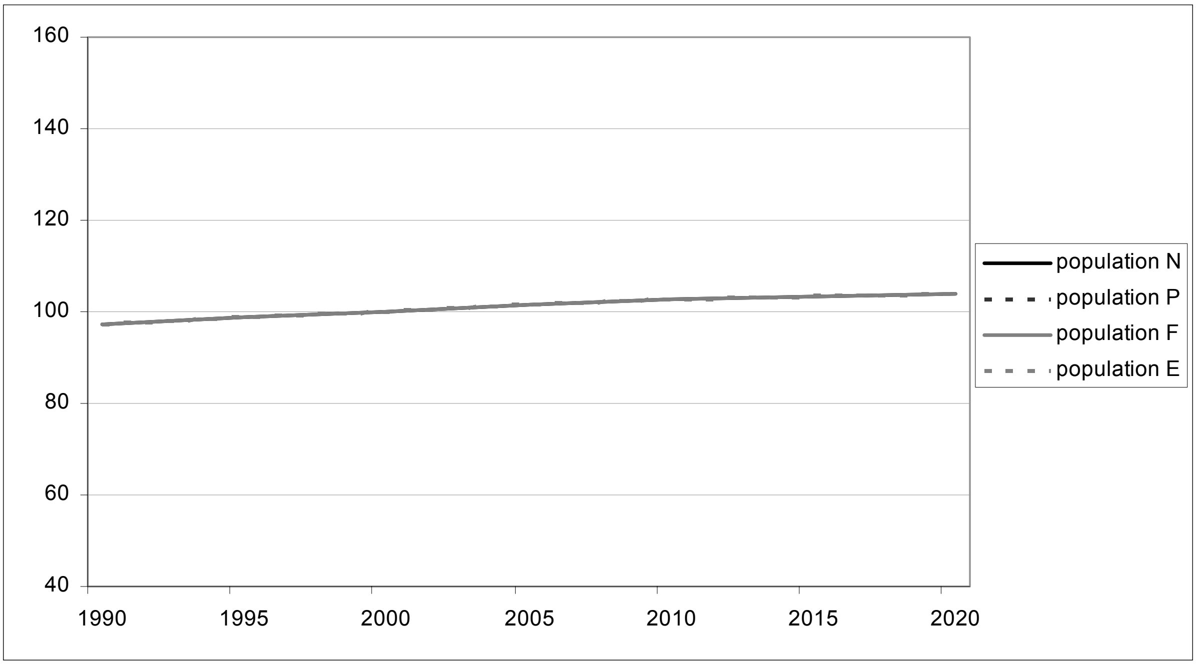
XVII.5. Transport intensity

The transport intensities are calculated on the basis of transport volumes, population figures and ton calculations by means of the SCENES model. The results are presented for each transport mode. The figures as presented in this chapter are supportive to the figures as presented within XVII.3.

The first paragraph gives an overview of the population growth, that will be compared with the transport growth in the last paragraphs.

XVII.5.1. Population growth

Figure 7: Population growth, EU25, 1990-2020, 2000 = 100



The overall population growth rates for EU25 are also provided by DG TREN (2005). In addition, the population growth rates for Switzerland and Norway have been collected from published sources. They are shown in the table below.

The overall size of the population in the EU25 area has grown from 453 million in 2000 to 459 million in 2005, at an annual rate of 0.26%. During this period, the population in the EU15 grew from 378 to 385 million, at an annual growth rate of 0.35%. The total population size in the NMS10 actually fell, from 74.0 to 73.4 million, although the situations are different across the countries. The population in the EU25 is expected to grow slowly to 464 million in 2010, implying a growth rate of 0.24% per year.

As with the GDP growth, it is important to note that the demographic structure of the European population has been changing, too. Smaller households, more affluent consumers and the continued aging of the population all contribute to changes in their life style, work, and as a result, the demand for transport.

XVII.5.2. Transport intensity passenger transport

Table 24 shows the transport intensity of passenger transport in all scenarios within the EU15. It shows that transport intensities of car transport are increased compared to the 2000 figures (approximately 2000 km). The White Paper measures do not influence the transport intensity of car transport. Impacts of White Paper measures on transport intensities of bus/coach, train and slow mode are not significant. However, if the full set of White Paper measures were implemented, but also if the extra measures are added to it, it would be possible to decrease the air transport intensity with 100 pkm/capita.

Within the NMS10, the car transport intensities are, just like it was the case within the EU15, growing with 2.000 pkm/capita. The White Paper measures have no significant impact to this growth. Bus/coach and train transport intensities are stable within the NMS10. Air and slow mode transport intensities are increasing. The most likely scenario (partial) shows that the White Paper measures do not influence the air and slow mode transport intensities. They are comparable to the reference (null) scenario.

Table 24: Transport intensity passenger transport (unit: pkm / population)

		Obs	Null		Partial		Full		Ext	
		2000	**2010**	**2020**	**2010**	**2020**	**2010**	**2020**	**2010**	**2020**
EU15	Car	10860	12081	13609	12076	13595	12238	13759	12250	12661
	Bus/coach	1066	1085	1043	1084	1041	1101	1081	1107	1128
	Train	932	1007	1050	1022	1083	1023	1090	1014	1163
	Air	752	1099	1460	1095	1478	967	1383	1001	1210
	Slow	571	626	647	626	647	619	637	615	649
	Total	**14181**	**15897**	**17810**	**15903**	**17844**	**15949**	**17950**	**15985**	**16811**
NMS10	Car	4364	6413	8521	6408	8503	6465	8377	6490	7869
	Bus/coach	1050	997	932	995	929	1000	927	1005	1012
	Train	690	679	669	691	692	695	686	687	808
	Air	193	319	472	317	474	300	445	302	431
	Slow	254	309	343	309	343	307	332	305	358
	Total	**6552**	**8717**	**10937**	**8720**	**10941**	**8767**	**10766**	**8789**	**10478**
EU25	Car	9788	11187	12833	11182	12818	11327	12967	11340	11930
	Bus/coach	1063	1071	1026	1070	1024	1085	1061	1091	1110
	Train	892	955	992	970	1023	971	1031	962	1109
	Air	660	976	1309	972	1325	862	1241	891	1091
	Slow	518	576	601	576	600	570	591	566	605
	Total	**12922**	**14764**	**16761**	**14770**	**16790**	**14815**	**16891**	**14849**	**15844**

XVII.5.3. Transport intensity freight transport

Table 25 shows the transport intensities of freight transport. The table shows that within the EU15 the transport intensities are not changing significantly for all transport modes. However within the NMS10, the IWW transport intensity is decreasing, as in the Partial Scenario, when the most likely set of White Paper measures is implemented, the IWW transport intensity decreases with 0.06 ton-km/ton. The White Paper measures have no significant impact of the transport intensities.

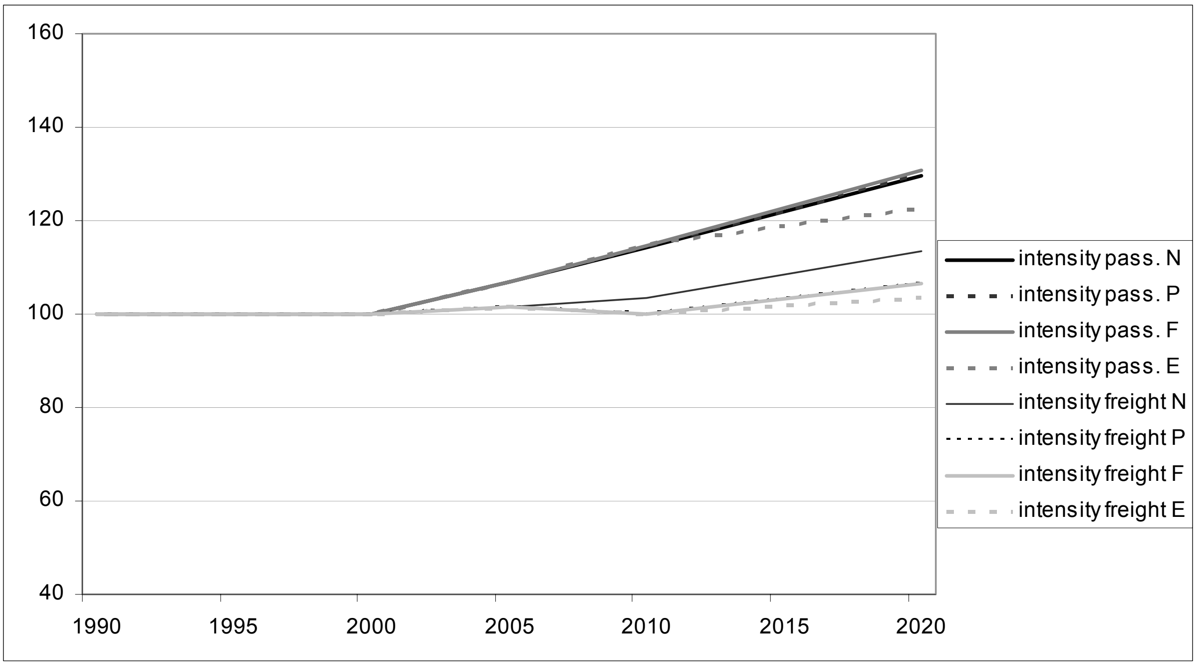
Table 25: Transport intensity freight transport (unit: tkm / ton)

		Obs	Null		Partial		Full		Ext	
		2000	**2010**	**2020**	**2010**	**2020**	**2010**	**2020**	**2010**	**2020**
EU15	Road freight	0.26	0.29	0.33	0.28	0.32	0.28	0.31	0.28	0.30
	Rail freight	0.13	0.12	0.11	0.12	0.11	0.12	0.11	0.12	0.11
	IWW	0.28	0.30	0.31	0.30	0.31	0.30	0.31	0.30	0.31
	Ship	2.10	2.12	2.26	2.14	2.28	2.13	2.27	2.14	2.29
	Other	0.38	0.40	0.43	0.39	0.43	0.40	0.43	0.39	0.43
	Total	**0.32**	**0.34**	**0.36**	**0.33**	**0.35**	**0.34**	**0.35**	**0.33**	**0.34**
NMS10	Road freight	0.29	0.30	0.29	0.29	0.28	0.29	0.28	0.29	0.27
	Rail freight	0.09	0.07	0.08	0.07	0.07	0.07	0.07	0.07	0.07
	IWW	0.15	0.09	0.08	0.09	0.08	0.09	0.08	0.09	0.08
	Ship	3.89	3.96	4.00	3.97	4.01	3.96	4.01	3.97	4.04
	Other	0.39	0.39	0.40	0.39	0.40	0.39	0.40	0.39	0.40
	Total	**0.22**	**0.22**	**0.26**	**0.21**	**0.23**	**0.20**	**0.23**	**0.19**	**0.22**
EU25	Road freight	0.26	0.29	0.32	0.28	0.31	0.28	0.30	0.28	0.30
	Rail freight	0.11	0.10	0.10	0.10	0.09	0.10	0.09	0.10	0.09
	IWW	0.28	0.28	0.29	0.28	0.29	0.28	0.29	0.28	0.29
	Ship	2.24	2.29	2.49	2.31	2.51	2.30	2.50	2.31	2.51
	Other	0.38	0.40	0.43	0.39	0.43	0.39	0.43	0.39	0.43
	Total	**0.30**	**0.31**	**0.34**	**0.30**	**0.32**	**0.30**	**0.32**	**0.30**	**0.31**

XVII.5.4. Summary

The table below gives an overview of the impact on transport intensity

Figure 8: Change in transport intensity for 4 scenarios, EU25, 2000-2020, 2000 = 100



XVII.6. Impact on accessibility

The impact of the White Paper on accessibility is measured on the reduction of congestion and accessibility of regions in terms of travel times to regions.
The reduction of congestion is an indicator for a more efficient use of the infrastructure and European vehicle fleet. As such a reduction of congestion will increase the efficiency of European transport services. Two factors are influencing the development of congestion: a) the development of traffic (influenced amongst others by transport demand policy, i.e. EC modal split objectives) and b) the capacity of the network (also influenced partially by transport policy; i.e. TEN's investment)
The regional impact of accessibility measure also have to be tested, in order to see if all regions are connected well to the TENs and offering them equal opportunities. A unified European transport network is essential to guarantee freedom of movement of goods and persons. The trans-European networks have gradually arisen as one of the driving forces for the achievement of growth, competitiveness and employment.

Congestion

As the SCENES model is a model that gives average values for the year, it is difficult on European level to get a precise idea of congestion which is often occurring on peak times during the day and are of expected (capacity) but also unexpected nature (accidents, bad weather). In this sense especially on the long term towards 2010 the trend can be analysed by observing average travel or trip times. The average trip time as derived from SCENES for all transport with an origin in the EU25 and a destination in the EU25 is used as an indicator for congestion. Table 23 and Table 26 show this indicator in the different scenarios in 2010 respectively 2020 with respect to the quantified objectives of the White Paper. For 2000 the absolute value is presented. The other columns show both the absolute and relative change. For the Null scenario this is a change compared to the year 2000 and for the other scenarios this is a change compared to Null scenario.

Table 26: Changes in average trip time 2010

		2000N (10^9 hours)	2010N compared to 2000N	Impact policy scenarios compared to trend development (hours)			2010N compared to 2000N	Impact policy scenarios compared to trend development		
	Mode			Partial	Full	Extended		Partial	Full	Extended
EU15	FRoad	6	0.5	-0.1	-0.2	-0.2	9.1%	-2.2%	-3.5%	-3.8%
	FRail	16	-1.1	-0.3	-0.6	-0.7	-6.6%	-2.2%	-3.7%	-4.7%
	FIww	37	0.3	-1.0	-1.8	-2.3	0.9%	-2.8%	-4.8%	-6.1%
	FShip	209	2.6	-5.4	-13.1	-13.2	1.2%	-2.6%	-6.2%	-6.2%
	FAirPipe	6	0.3	0.0	0.0	0.0	4.8%	-0.5%	-0.6%	-0.7%
	PCar	2	0.0	0.0	0.0	0.0	2.6%	0.0%	-0.3%	-1.4%
	PRail	2	0.1	0.0	0.0	0.0	6.5%	-0.5%	-0.4%	-0.8%
	PBus	3	0.0	0.0	0.0	0.0	0.3%	0.1%	-0.8%	-1.5%
	Pair	10	0.2	-0.1	-0.2	-0.3	2.1%	-0.8%	-1.8%	-3.2%
NMS10	FRoad	7	0.4	-0.2	-0.3	-0.4	6.3%	-2.9%	-4.4%	-5.3%
	FRail	9	-3.9	-0.3	-0.4	-0.4	-45.4%	-6.1%	-7.9%	-9.4%
	FIww	18	-10.0	0.0	-0.2	-0.2	-54.4%	-0.3%	-1.9%	-1.9%
	FShip	253	-4.4	-4.6	-11.6	-11.4	-1.8%	-1.9%	-4.7%	-4.6%
	FAirPipe	6	0.0	0.0	0.0	0.0	-0.6%	0.0%	-0.6%	-0.2%
	PCar	4	-0.1	0.0	0.0	0.0	-1.5%	0.0%	0.0%	-1.0%
	PRail	3	0.1	0.0	0.0	0.0	3.2%	-0.3%	-0.7%	-1.1%
	PBus	77	-4.5	-0.2	-0.5	-1.0	-5.9%	-0.2%	-0.7%	-1.4%

	Pair	9	0.4	-0.1	-0.4	-0.5	3.9%	-0.9%	-3.8%	-5.2%
EU25	FRoad	6	0.5	-0.2	-0.2	-0.3	9.1%	-2.3%	-3.7%	-4.1%
	FRail	13	-2.6	-0.5	-0.9	-1.0	-19.8%	-4.6%	-8.2%	-10.1%
	FIww	36	-1.3	-0.9	-1.6	-2.1	-3.6%	-2.7%	-4.7%	-6.0%
	FShip	212	2.4	-5.3	-13.1	-13.1	1.1%	-2.5%	-6.1%	-6.1%
	FAirPipe	6	0.3	0.0	0.0	0.0	4.5%	-0.5%	-0.6%	-0.7%
	PCar	2	0.1	0.0	0.0	0.0	3.1%	0.0%	-0.2%	-1.3%
	PRail	2	0.1	0.0	0.0	0.0	5.8%	-0.4%	-0.4%	-0.8%
	PBus	12	-1.6	0.0	-0.2	-0.2	-12.7%	-0.2%	-1.4%	-2.3%
	Pair	10	0.2	-0.1	-0.2	-0.3	2.1%	-0.8%	-2.0%	-3.4%
EU 15	**Freight**	**20**	**-0.2**	**-0.3**	**-0.3**	**-0.4**	**-1.0%**	**-1.7%**	**-1.7%**	**-2.3%**
	Pass.	**2**	**0.1**	**0.0**	**0.0**	**0.0**	**3.8%**	**-0.2%**	**-1.3%**	**-2.1%**
	Total	**8**	**-0.3**	**0.0**	**-0.1**	**-0.1**	**-3.5%**	**-0.3%**	**-0.9%**	**-1.1%**
NMS10	**Freight T**	**12**	**-3.0**	**-0.5**	**-0.8**	**-1.0**	**-25.1%**	**-5.3%**	**-8.9%**	**-10.8%**
	Pass. T	**13**	**-3.1**	**0.0**	**-0.1**	**-0.2**	**-23.8%**	**-0.3%**	**-1.3%**	**-2.2%**
	Total	**12**	**-3.0**	**-0.3**	**-0.6**	**-0.8**	**-24.7%**	**-3.7%**	**-6.5%**	**-8.2%**
EU25	**Freight T**	**18**	**-1.2**	**-0.5**	**-0.7**	**-0.8**	**-6.5%**	**-2.7%**	**-3.8%**	**-4.9%**
	Pass. T	**3**	**-0.1**	**0.0**	**0.0**	**-0.1**	**-3.0%**	**-0.2%**	**-1.2%**	**-2.0%**
	Total	**9**	**-0.6**	**-0.1**	**-0.1**	**-0.2**	**-6.8%**	**-0.8%**	**-1.7%**	**-2.1%**

Table 27: Changes in average trip time 2020

	Mode	2000N (10^9 hours)	2020N compared to 2000N	Impact policy scenarios compared to trend development (hours)			2020N compared to 2000N	Impact policy scenarios compared to trend development		
				Partial	Full	Extended		Partial	Full	Extended
EU15	FRoad	6	1.4	-0.1	-0.3	-0.4	23.0%	-1.9%	-4.3%	-5.0%
	FRail	16	-1.9	-1.1	-1.9	-2.4	-12.1%	-8.0%	-13.7%	-17.4%
	FIww	37	1.0	-1.4	-2.3	-3.1	2.7%	-3.7%	-6.1%	-8.3%
	FShip	209	4.7	-6.4	-13.1	-13.8	2.3%	-3.0%	-6.1%	-6.5%
	FAirPipe	6	0.9	0.0	-0.1	-0.1	14.0%	-0.6%	-1.1%	-1.1%
	PCar	2	0.1	0.0	0.0	-0.1	6.1%	-0.2%	-0.6%	-5.1%
	PRail	2	0.1	0.0	0.0	0.1	8.3%	-1.0%	-1.4%	4.1%
	PBus	3	0.0	0.0	-0.1	0.0	-1.3%	0.1%	-1.8%	0.4%
	Pair	10	0.4	-0.1	-0.2	-0.6	4.0%	-1.1%	-2.2%	-5.3%
NMS10	FRoad	7	0.3	-0.3	-0.5	-0.6	4.0%	-3.7%	-6.7%	-9.3%
	FRail	9	-4.4	-0.5	-0.6	-0.6	-51.5%	-10.9%	-14.8%	-15.2%
	FIww	18	-11.5	-0.1	-0.1	-0.2	-62.8%	-1.1%	-2.2%	-2.8%
	FShip	253	-7.0	-4.6	-11.6	-6.4	-2.8%	-1.9%	-4.7%	-2.6%
	FAirPipe	6	0.1	0.0	0.0	0.0	1.4%	-0.2%	-0.7%	-0.3%
	PCar	4	-0.1	0.0	0.0	-0.1	-2.0%	-0.1%	-0.7%	-3.7%
	PRail	3	0.2	0.0	0.0	0.1	7.8%	-0.5%	-1.1%	3.7%
	PBus	77	-4.2	-0.4	-1.6	-8.2	-5.4%	-0.5%	-2.2%	-11.2%
	Pair	9	0.7	-0.1	-0.4	-0.8	7.2%	-1.0%	-4.2%	-8.2%
EU25	FRoad	6	1.2	-0.2	-0.3	-0.4	20.1%	-2.2%	-4.7%	-5.7%
	FRail	13	-3.0	-1.2	-1.6	-1.8	-22.8%	-11.8%	-16.1%	-18.1%
	FIww	36	-1.0	-1.3	-2.1	-2.8	-2.9%	-3.6%	-6.0%	-8.2%
	FShip	212	5.4	-6.2	-13.0	-13.0	2.5%	-2.8%	-6.0%	-6.0%
	FAirPipe	6	0.8	0.0	-0.1	-0.1	13.2%	-0.6%	-1.1%	-1.1%
	PCar	2	0.1	0.0	0.0	-0.1	6.8%	-0.2%	-0.6%	-5.0%
	PRail	2	0.1	0.0	0.0	0.1	7.9%	-0.9%	-1.3%	4.6%
	PBus	12	-2.1	0.0	-0.4	-0.5	-17.2%	-0.3%	-3.5%	-5.1%
	Pair	10	0.4	-0.1	-0.2	-0.6	4.1%	-1.1%	-2.3%	-5.5%
EU 15	**Freight**	**20**	**-0.1**	**-0.2**	**-0.5**	**-0.7**	**-0.7%**	**-1.1%**	**-2.4%**	**-3.7%**

	Pass.	2	0.2	0.0	0.0	-0.1	7.8%	-0.2%	-1.4%	-4.9%
	Total	8	-0.3	0.0	-0.1	-0.1	-4.0%	-0.1%	-0.9%	-1.1%
NMS10	Freight T	12	-1.9	-1.1	-1.3	-1.5	-16.2%	-10.7%	-13.6%	-14.6%
	Pass. T	13	-4.5	-0.1	-0.2	-0.1	-34.5%	-0.6%	-1.8%	-0.8%
	Total	12	-2.8	-0.7	-0.9	-1.0	-23.1%	-7.3%	-9.7%	-10.2%
EU25	Freight T	18	-1.0	-0.7	-1.0	-1.2	-5.4%	-4.0%	-5.6%	-6.8%
	Pass. T	3	-0.1	0.0	0.0	-0.1	-3.1%	-0.4%	-1.5%	-3.6%
	Total	9	-0.6	-0.1	-0.2	-0.2	-6.8%	-1.2%	-2.3%	-2.6%

The White Paper argues that increasing success of road and air transport is resulting in ever worsening congestion, while, paradoxically, failure to exploit the full potential of rail and short-sea shipping is impeding the development of real alternatives to road haulage. This persisting situation is leading to an uneven distribution of traffic generating increasing congestion, particularly on the main trans-European corridors and in towns and cities. To solve this problem, the White Paper aims to firstly regulate competition between modes and secondly link the modes of transport. In the Null Scenario in 2010 the congestion on the road will increase with 9.1% for freight transport and 3.1% for cars. This partly caused by longer trip lengths. Because of the fact that the average trip time of some other modes decreases, the total average trip time in the EU25 will decrease with 6.8%, this as a result of transport demand policies. In the New Member states the average trip will even decrease with 24.7%. This is mainly caused by faster transport of freight by rail and IWW.

Due to the implementation of the White Paper the growth of the average road freight travel time is reduced with 2.3%, and there is no effect on the average travel time by car. The aim of the White paper measures is to reduce congestion on the road. The results show that there will indeed be an improvement. This is the case in 2010 and also in 2020.

If the complete White Paper was implemented, the growth of the average travel time by road had been reduced further up to 3.7% for freight and 0.2% for passengers. In the extended scenario these effects are even stronger. In 2010, the congestion as measured by average travel times can be reduced with respectively 4.1% and 1.3% for freight and passenger transport (compared to the null scenario).
Given the growth of transport in notably the NMS but also in the EU15 the reduction of travel times as foreseen in the modelling exercise, accomplished by demand policies and investment in infrastructure, is a major accomplishment by the White Paper policies.

Accessibility

The development of the trans-European network should help to strengthen economic and social cohesion within the Community. Accessibility is defined as the time needed to get from one region to the other regions. This indicator is computed as the average (not weighted) travel time from a region (within a country) to all other regions by all modes.

The tables below show this indicator in the different scenarios in 2010 respectively 2020. For 2000 the absolute value is presented. The other columns show both the absolute and relative change. For the Null scenario this is a change compared to the year 2000 and for the other scenarios this is a change compared to Null scenario. The table contain information on the country level. Figure 9 to Figure 12 contain the same information as the table for 2010 whit the difference that these show the accessibility on a regional (NUTS 2) level.

Table 28: Changes in accessibility for 2010

Country	2000N (hours)	2010N compared to 2000N (hours)	Impact policy scenarios compared to trend development (hours)			2010N compared to 2000N	Impact policy scenarios compared to trend development		
			Partial	Full	Extended		Partial	Full	Extended
AT	82	0.3	-1.7	-3.9	-3.8	0.4%	-2.1%	-4.8%	-4.6%
BE	71	-0.5	-1.7	-3.5	-3.9	-0.7%	-2.5%	-5.0%	-5.5%
DE	72	-0.4	-1.6	-3.3	-3.4	-0.6%	-2.2%	-4.6%	-4.8%
DK	79	1.6	-2.1	-4.7	-4.9	2.0%	-2.7%	-5.9%	-6.1%
ES	93	-5.6	-2.3	-6.1	-6.2	-6.0%	-2.7%	-7.0%	-7.1%
FI	121	-4.9	-3.1	-6.0	-6.3	-4.1%	-2.7%	-5.2%	-5.4%
FR	74	-0.4	-1.5	-3.2	-3.4	-0.5%	-2.0%	-4.4%	-4.7%
GR	105	0.3	-1.5	-4.3	-4.4	0.3%	-1.4%	-4.0%	-4.1%
IE	86	1.2	-1.7	-4.0	-4.2	1.4%	-1.9%	-4.6%	-4.8%
IT	97	-3.5	-2.3	-5.4	-5.6	-3.6%	-2.4%	-5.8%	-6.0%
LU	71	-0.5	-1.7	-3.5	-3.9	-0.7%	-2.5%	-5.0%	-5.5%
NL	72	-1.0	-1.7	-3.7	-4.1	-1.4%	-2.4%	-5.2%	-5.8%
PT	97	-3.5	-2.6	-7.2	-7.4	-3.6%	-2.8%	-7.7%	-7.9%
SE	115	-0.1	-3.2	-6.6	-6.7	-0.1%	-2.8%	-5.8%	-5.9%
UK	78	-0.7	-2.0	-4.4	-4.7	-0.9%	-2.6%	-5.7%	-6.0%
CY	139	0.6	-2.3	-5.9	-6.5	0.5%	-1.7%	-4.2%	-4.7%
CZ	36	-0.5	-0.4	-0.7	-1.0	-1.4%	-1.1%	-2.1%	-2.9%
EE	102	8.6	-2.9	-1.8	-4.4	0.8%	-0.3%	-1.7%	-4.4%
HU	53	-3.9	-0.1	0.1	0.1	-7.4%	-0.1%	0.2%	0.2%
LT	109	-1.3	-2.1	-5.5	-1.6	-1.2%	-0.2%	-0.5%	-1.5%
LV	110	-4.9	-1.0	-1.2	-2.3	-4.5%	-0.1%	-1.2%	-2.2%
MA	112	2.6	-2.3	-6.1	-6.3	2.4%	-2.0%	-5.3%	-5.5%
PL	48	-4.1	-0.4	0.0	-0.3	-8.6%	-0.8%	-0.1%	-0.6%
SI	95	-9.0	-1.6	-1.2	-2.3	-0.9%	-0.2%	-1.3%	-2.5%
SK	50	-2.3	-0.7	-1.7	-2.0	-4.6%	-1.5%	-3.7%	-4.2%
EU15	**89**	**-1.2**	**-1.8**	**-4.0**	**-4.3**	**-1.4%**	**-2.4%**	**-5.4%**	**-5.6%**
NMS10	**73**	**0.3**	**-1.7**	**-3.9**	**-3.8**	**-1.7%**	**-1.4%**	**-3.3%**	**-3.7%**
EU25	**84**	**-0.5**	**-1.7**	**-3.5**	**-3.9**	**-1.5%**	**-2.1%**	**-4.9%**	**-5.1%**

Table 29: Changes in accessibility for 2020

Country	2000N (hours)	2020N compared to 2000N (hours)	Impact policy scenarios compared to trend development (hours)			2020N compared to 2000N	Impact policy scenarios compared to trend development		
			Partial	Full	Extended		Partial	Full	Extended
AT	82	1	-2	-4	-5	0.8%	-2.7%	-5.3%	-6.1%
BE	71	-1	-2	-4	-5	-1.3%	-3.6%	-6.3%	-7.6%
DE	72	0	-2	-4	-5	-0.5%	-3.3%	-5.7%	-7.5%
DK	79	1	-3	-6	-7	1.9%	-3.8%	-7.1%	-9.3%
ES	93	-7	-3	-7	-8	-7.9%	-3.6%	-7.9%	-9.5%
FI	121	-6	-5	-8	-10	-4.8%	-4.3%	-7.0%	-8.8%
FR	74	-1	-2	-4	-5	-0.8%	-3.1%	-5.5%	-6.8%
GR	105	1	-2	-5	-6	1.4%	-2.2%	-4.7%	-5.3%
IE	86	1	-2	-5	-5	1.4%	-2.4%	-5.4%	-6.3%
IT	97	-3	-3	-6	-9	-3.5%	-3.6%	-6.9%	-9.4%
LU	71	-1	-2	-4	-5	-1.3%	-3.6%	-6.3%	-7.6%
NL	72	-2	-3	-5	-6	-2.2%	-3.6%	-6.6%	-8.3%
PT	97	-3	-4	-8	-10	-3.0%	-4.0%	-9.0%	-11.0%
SE	115	0	-5	-8	-10	-0.4%	-4.2%	-6.9%	-8.3%
UK	78	-2	-3	-5	-6	-1.9%	-3.8%	-6.8%	-8.0%
CY	139	1	-4	-7	-8	0.7%	-2.5%	-5.2%	-5.6%
CZ	36	-1	-1	-1	-1	-3.3%	-1.9%	-3.1%	-4.3%
EE	102	-2	-1	-2	-4	0.0%	0.0%	-2.9%	-4.8%
HU	53	-7	0	-1	0	-12.9%	-0.6%	-1.2%	0.6%
LT	109	-3	-1	-3	-3	-2.6%	-0.9%	-2.3%	-3.3%

LV	110	-9	0	-2	-5	-8.5%	-0.3%	-2.5%	-4.7%
MA	112	3	-3	-7	-8	2.5%	-2.8%	-6.2%	-7.1%
PL	48	-6	-1	0	0	-12.0%	-1.3%	-1.0%	0.4%
SI	95	-2	-3	-2	-4	-2.4%	0.0%	-2.7%	-4.2%
SK	50	-4	-1	-2	-3	-8.3%	-2.4%	-5.1%	-6.6%
EU15	**89**	**-2**	**-3**	**-5**	**-6**	**-1.6%**	**-3.5%**	**-6.5%**	**-8.0%**
NMS10	**73**	**1**	**-2**	**-4**	**-5**	**-3.2%**	**-2.2%**	**-4.4%**	**-4.7%**
EU25	**84**	**-1**	**-2**	**-4**	**-5**	**-2.0%**	**-3.1%**	**-6.0%**	**-7.2%**

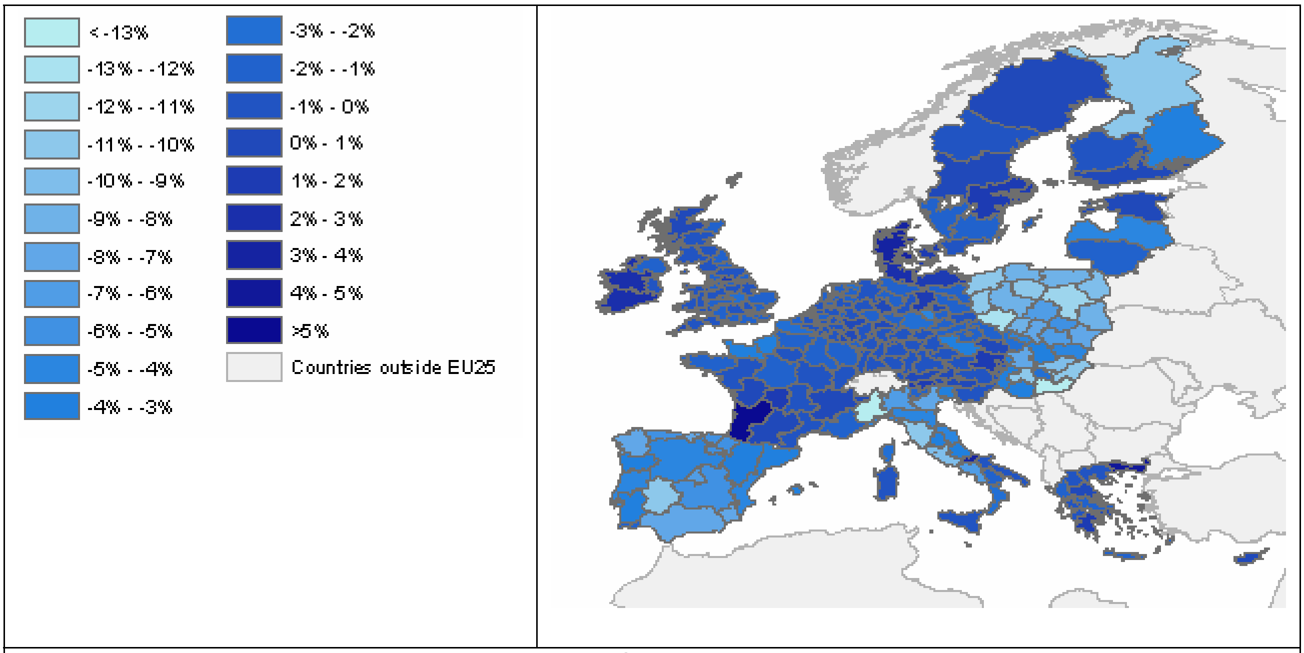


Figure 9: Relative change in accessibility in the Null Scenario, 2000-2010

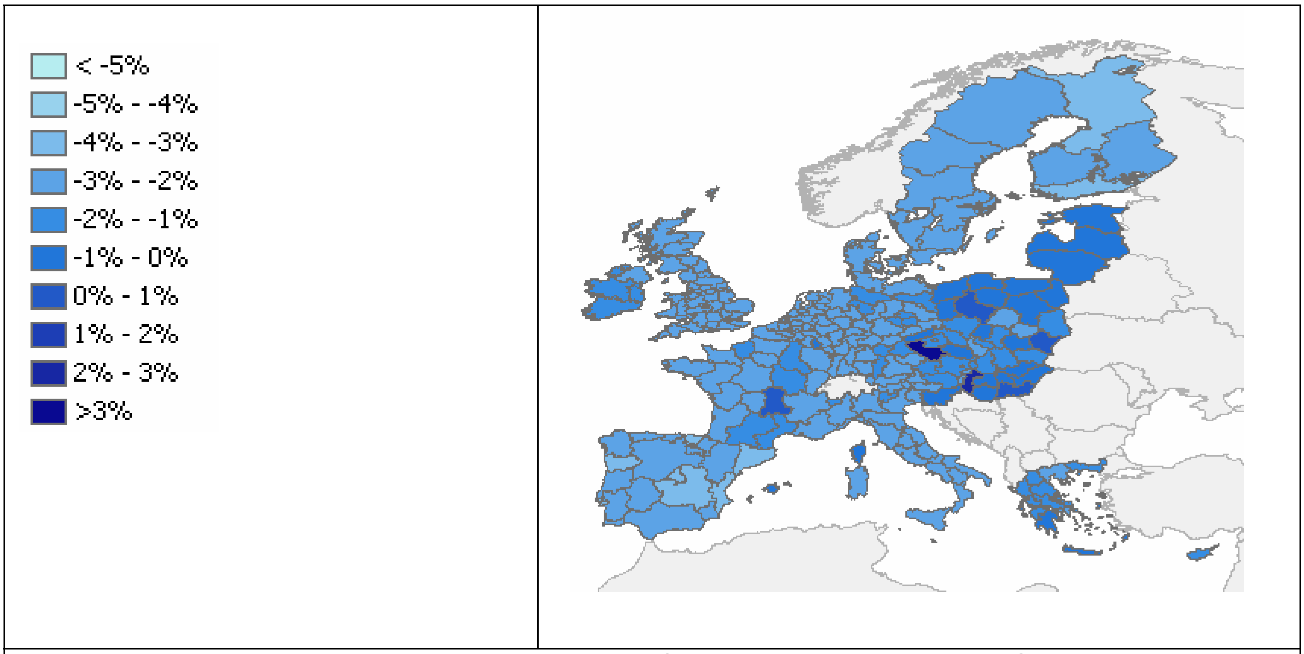


Figure 10: Relative change in accessibility in the Partial Scenario compared to the Null Scenario, 2010

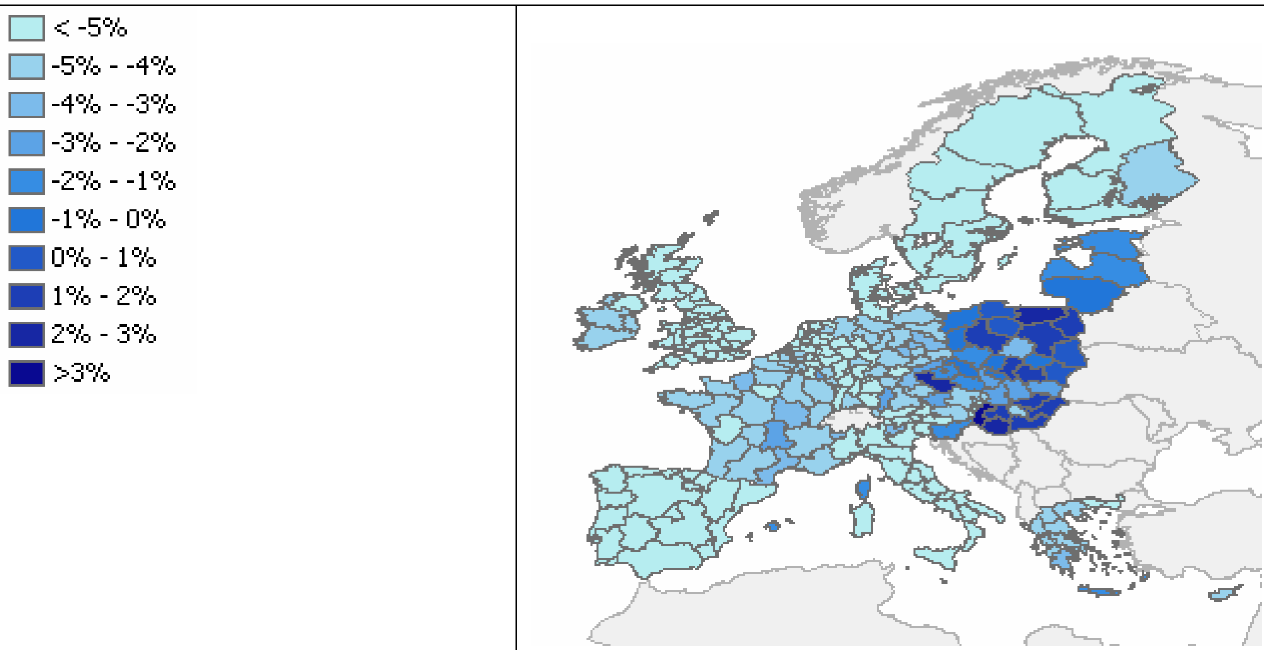


Figure 11: Relative change in accessibility in the Full Scenario compared to the Null Scenario, 2010

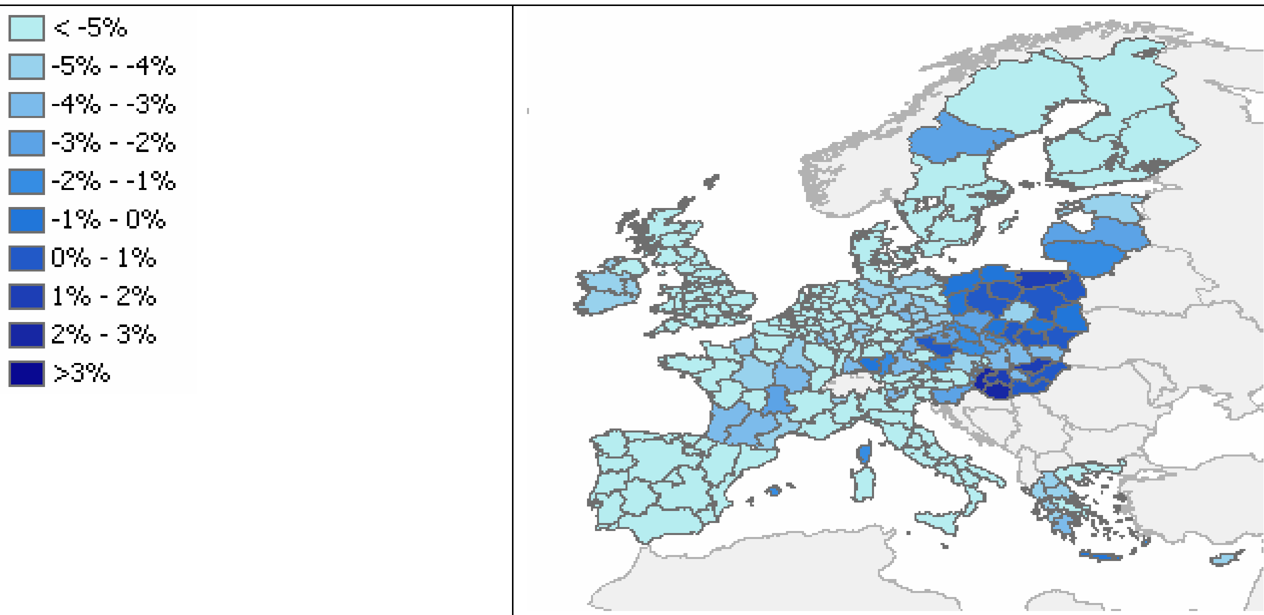


Figure 12: Relative change in accessibility in the extended scenario compared to the null scenario, 2010

The White Paper states the following about accessibility: *Building the trans-European transport network*. The main aims are: removing the bottlenecks in the railway network, completing the routes identified as the priorities for absorbing the traffic flows generated by enlargement, particularly in frontier regions, and improving access to outlying areas.

From Table 28 it can be concluded that the accessibility in the EU15, in the NMS10 and in the EU25 will improve with respectively 1.4%, 1.7% and 1.5% for the N-scenario. This is in line with the objectives of the White Paper, especially since the accessibility of NMS10 is improving more than the accessibility of the other countries. The implementation of the White Paper measure improves the accessibility of the countries of the EU15, the new Member States and the EU25 with respectively 2.4%, 1.4% and 2.1% compared to the Null Scenario. The objectives of the White Paper will be met since the accessibility of the outlying areas (new Member States) will improve. The only minus is that the accessibility of the new Member States improves less than the accessibility of the EU15.

If the complete White Paper was implemented, the accessibility had been improved up to 4.9% compared to the Null Scenario, which is an additional improve of 2.8 percent points compared to the Partial Scenario. In the extended scenario, the accessibility improves with 5.1%. In both the full and extended scenario the accessibility of the EU15 countries improves more than the accessibility of the New Member states. It can be stated that the policies as proposes in the White Paper help in improving the accessibility of regions, notably some peripheral regions in the NMS are not advancing in the same rate as for other countries.

XVII.7. Impact on transport growth and decoupling

This chapter analysis the White Paper objective on decoupling: breaking the link between transport growth and GDP.

In the first paragraph, an overview of the GDP evolution is given; The last paragraphs analysi the decoupling for passenger and freight transport.

XVII.7.1. Baseline GDP evolution

The four transport policy scenarios are different in terms of the policies considered and/or their level of implementation. However all the scenarios share common assumptions concerning the exogenous trends of population, GDP growth, etc.. The quantification of such assumptions is based on the updated forecasts that are being developed by the Commission for each EU Members. The projections concerning GDP growth are reported in the table below.

Table 107: GDP and economic growth in the EU in 2010 and 2020

	2000 GDP bln Euro	2010 GDP bln Euro	2020 GDP bln Euro	2000-2010 % yearly growth	2010-2020 % yearly growth
EU25	9366.8	11459.2	14196.9	2.0%	2.2%
EU15	8969.6	10870.4	13325.3	1.9%	2.1%
NMS10	397.3	588.8	871.5	4.0%	4.0%

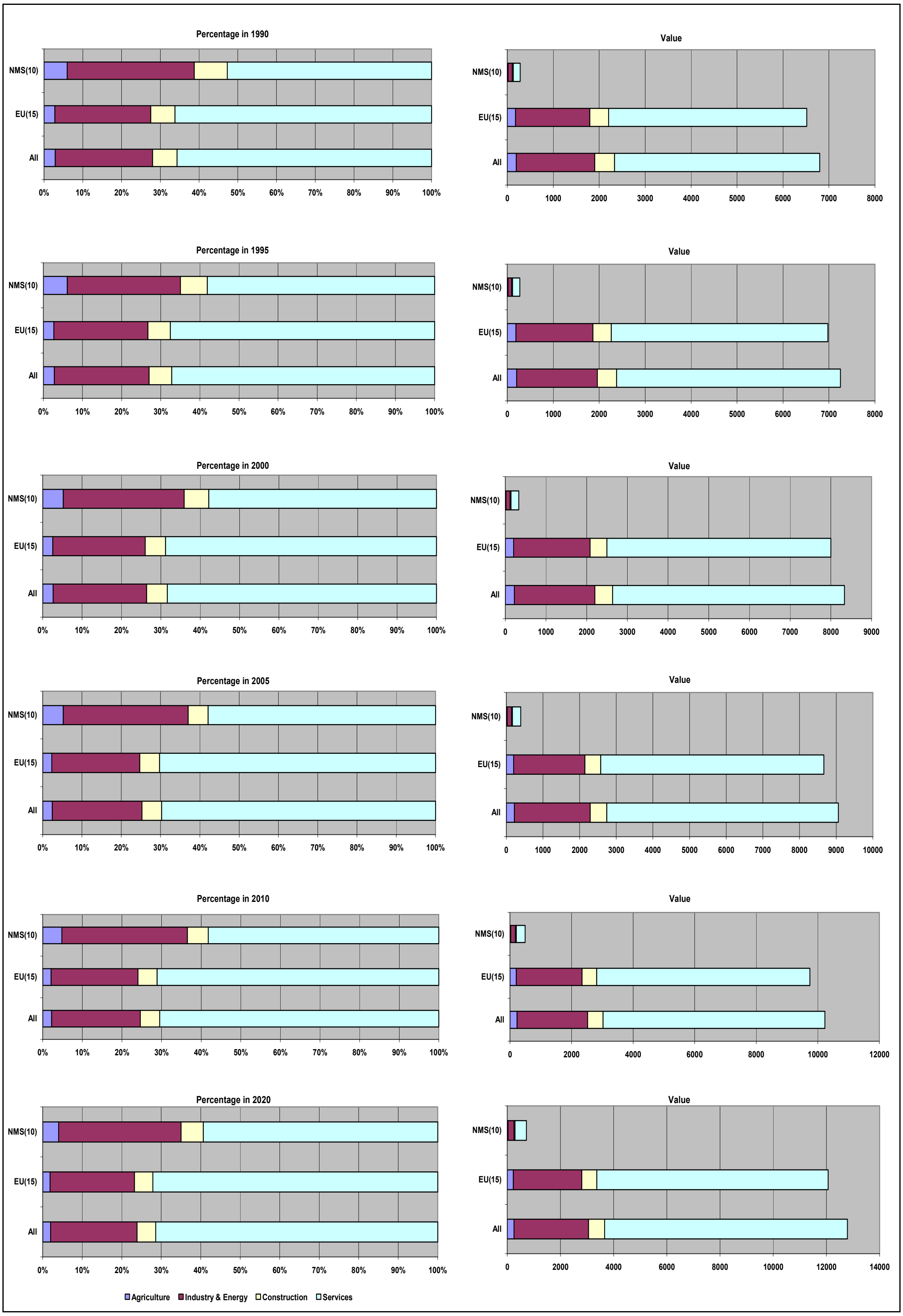
According to official statistics (European Commission, 2005) the overall GDP for EU25 is expected to grow from 8 947 billion in 2000 to 9 716 billion in 2005 (measured in 2000 prices). This implies a growth rate of 1.7% per year on average. The growth from 2005 to 2010 is expected to be 2.4% per year. Over the period of 2000-2010, the average GDP growth rate will then be 2.0%. This is considerably lower than the assumption made in the White Paper in 2001, of a 3% annual GDP growth rate.

The growth in GDP is much faster in the NMS10 starting from a lower base (3.6% per year during 2000-2005), than in EU15 (1.6% per year). Over the period 2000-2010, the annual GDP growth rate is expected to be 4% in the NMS10, and 1.9% in EU15.

Growths in imports and exports are assumed by this study in line with the GDP forecast, by assuming that foreign trade will continue to grow at a faster rate than domestic production. In defining the foreign trade growth rates, observed historic ratios between foreign trade and domestic production growths by industry by Member State (from the Eurostat macro-economic data) have been used. In adopting the historic ratios some capping has been necessary to build in a minimum amount of domestic production for each industry, even in those sectors that have seen very high foreign trade growth rates. These growth rates are used for projecting the national input-output tables of the EU15 countries forward to 2010 and 2020, and they influence the demand for domestic and foreign trade, and hence freight transport demand.

Along with the overall GDP growth there is a significant change in the structure of the European economy and its systems of production (Figure 13). This is a continuation of the trend during the last 20 years, which have seen a much stronger growth in the service industries and as a result a growing percentage share of the service sector compared with other industries.

Figure 13: Evolution of European economies 1990-2020



Source: European Commission, 2005

GDP values are measured in constant 2000 market prices in million Euro.

XVII.7.2. Impact on decoupling

Table 30 and Table 31 summarises the transport economic performance in the different scenarios in 2010 respectively 2020 with respect to the quantified objectives of the White Paper. The figures in the first row of each quantified objective show the absolute change. The first cell displays the absolute change compared to the 2000 figure if there was no White Paper available. The other cells display the effects of implementing policy. The second row identifies the perceptual change.

All figures are based on 2010 estimates, unless it is clearly indicated that 2020 estimates are used.

The indicator market only displays the absolute change.

Table 30: Validating White Paper objectives using estimates for 2010

Objective	Indicator	Unit	Reference (Null Scenario 2010 compared to 2000)	Impact policy scenarios compared to reference development		
				Partial	Full	Ext
Breaking the link between GDP and transport growth	Transport volume	billion ton-km p. year	+349.6	-40.9	-72.9	-95.3
		%	+23.4	-2.2	-4.0	-5.2
	Transport intensity	million ton-km/ton p. year	+50.8	-5.6	-10.1	-13.2
		%	+11.9	-1.2	-2.1	-2.8
	Transport volume	billion passenger-km p. year	+755.9	-2.3	+65.1	+71.2
		%	+17.1	0.0	+1.3	+1.4
	Transport intensity	Kilometre per capita p. year	+ 1401.7	-5.0	+140.7	+153.
		%	+ 14.3	0.0	+1.3	+1.4

Table 31: Validating White Paper objectives using estimates for 2020

Objective	Indicator	Unit	Reference (Null Scenario 2020 compared to 2000)	Impact policy scenarios compared to reference development		
				Partial	Full	Ext
Breaking the link between GDP and transport growth	Transport volume	billion ton-km p. year	+783.1	-138.3	-222.0	-306.9
		%	+52.4	-6.1	-9.7	-13.5
	Transport intensity	million ton-km/ton p. year	+102.3	-15.6	-25.6	-36.1
		%	+23.9	-1.2	-2.1	-2.8
	Transport volume	Billion passenger-km p. year	+1582.8	-6.7	+62.9	-422.1
		%	+35.8	-0.1	+1.0	-7.0
	Transport intensity	Kilometre per capita p. year	+3033.8	-14.3	+134.3	-901.2
		%	+31.0	-0.1	+1.0	-7.0

XVII.7.3. Freight transport

White Paper objective: "Breaking the link between the growth of car transport and economic growth: road haulage +38% instead of predicted 50%".

The White Paper states that by implementing the measures as set out in the White Paper there will be a marked break in the link between transport growth and economic growth, although without there being any need to restrict the mobility of people and goods. There would also be much slower growth in road haulage thanks to better use of the other means of transport. Based on the SCENES results it is possible to assess if the road freight growth is reduced between 1998 and 2010 from the expected 50% to the desired 38%. However, the SCENES results show that the growth without White Paper policy intervention, the Null Scenario, of the road freight sector between 2000 and 2010 is 23% (and not 50%). This growth is lower than indicated in the White Paper (50%) due to lower GDP growth rates than expected in the period 2001-2005.

Due to the implementation of the White Paper the growth of the road freight transport is reduced with 2.2%, as policy results in a reduction of transport volumes of 40 billion ton-km. The White Paper argued on basis of the information available in 2001 that a reduction of road haulage with approximately one quarter (from 50 to 38%) is feasible with the package of measures proposed. The results however, incorporating developments between 2001-2005, show that if the most likely development (partial scenario) is implemented, a reduction of only one tenth (from 23% to 21%) is more realistic. This is significantly lower than the reduction of a quarter in road haulage growth that was expected in 2001.

If the complete White Paper was implemented, the growth of the road freight transport had been reduced with an additional 2%, up to 4%, compared to the most likely (partial) scenario. In that case the transport volumes were decreasing with an additional 30 billion ton-km, up to 73 billion ton-km. Also a reduction of road haulage of one fifth was realised (reducing the growth from 23% to 19%). Still, this is lower than the reduction of a quarter in road haulage growth that was expected in 2001.

The autonomous growth (null scenario) of the road freight transport sector is highest in the central and eastern European countries. The amount of ton-km is increasing over there with 65%, whereas in the EU15 the growth is only 18%. Latvia, Lithuania and Poland nearly double the road freight, whereas Hungary and Slovenia have a growth that is significantly lower than average (20-25%). In the EU15 it are mainly Germany and Spain (both +40%), but especially Ireland (+60%) that are contributing to the growth in road freight transport volumes. Finland and the United Kingdom have a growth rate that is much lower than average (+5% respectively +10%). White Paper measures mainly affect the South-West European countries (France, Spain, Italy), but also Poland. They have less impact on road freight in Greece and Estonia.

XVII.7.4. Passenger transport

White Paper objective: Breaking the link between the growth of car transport and economic growth: passenger car transport +21%

The White Paper states that by implementing the 60-odd measures as set out in the White Paper there will be a marked break in the link between transport growth and economic growth, although without there being any need to restrict the mobility of people and goods. The expected impact of this would be a slower growth in passenger transport by car (increase in traffic of 21% against a rise in GDP of 43%). Based on the SCENES results it is possible to assess if the growth in car passenger transport is lower than anticipated.

It is shown that the absolute growth of the passenger transport by car due to implementation of the White Paper measures is 2.3 billion passenger-km lower in the partial scenario than in the do nothing (null) scenario . However, when the White Paper would be fully implemented or when the extended policy scenario would be implemented, than passenger transport by car is growing faster than the reference development of the null scenario. Figures vary between +64 billion passenger-km and +71 billion passenger-km. It seems that the White Paper, if applied fully, does not result in the preferred impact. Instead of a reduction of car passenger transport in 2010 (compared to the reference development), the car passenger transport is estimated to increase with 1 percent point. Also per capita the car passenger transport volumes are increasing. This unexpected growth of passenger car transport in the full and extended policy scenarios is explained by the exclusion of pricing measures for passenger transport in all scenarios for 2010. The small growth of car traffic compared to the reference (the null scenario) is the result of investments like Galileo which assumingly decreases transport times in both freight and passenger road transport. Only in the extended scenario pricing is introduced in 2011 and therefore a reduction of 422 billion passenger car kilometres is seen in the extended scenario 2020 compared to the reference development of the null scenario (see Table 31).

Just like the growth of freight transport, the autonomous growth (Null Scenario) of passenger car transport is the highest in central and eastern European countries (approximately 45%). Latvia and Poland have a growth in passenger car transport that is a little bit higher than average (49% respectively 55%). Growth is lowest in Slovakia and Slovenia (26% respectively 19%). The United Kingdom has the highest growth in passenger car transport of the EU15 (+20%). Denmark, Italy and Portugal have a growth rate that is significantly lower than the average 14% growth in the EU15 (6-7% for all three countries). The proposed and implemented ensemble of White Paper measures mainly impact passenger car transport in the car minded countries (Germany, France and Italy).

It can be concluded that it is unlikely that the implementation of the White Paper, partially or fully, will result in a break in the link between passenger transport growth and economic growth. There are even no measures proposed in the White Paper that aim at achieving this objective. Due to the implementation of the White Paper measures (partial scenario) the passenger transport by car is, compared to the reference (the null scenario), even increasing a little instead of decreasing. However, in the extended scenario, due to introduction of pricing in 2011, a reduction of 422 billion passenger car kilometres is seen in 2020 compared to the reference (the null scenario). Such a substantial modal shift confirms that pricing is one of the few possibilities to realise a shift in the modal split.

XVII.8. Macroeconomic impact

The estimate of the macroeconomic impact of the ASSESS policy scenarios has been carried out using the ASTRA System Dynamics model. Traditionally, three main approaches are used to analyse links between transport and economy: Macroeconomic approach, Microeconomic approach and General Equilibrium approach. Each of such approaches focuses on specific economic variables and none of them is able to fully address the multiple dimensions involved in the White Paper measures. System Dynamics, even if not specifically devoted to analyse the links between transport and economy, has been recently used for this objective in several European research projects and proved its flexibility and capability of including both micro and macro variables in the analysis.. For these reasons, completeness and availability, ASTRA has been selected as the most suitable model to assess the macroeconomic effects of the ASSESS policy scenarios.

The ASTRA model is a System Dynamics model at the European scale focused on describing the linkages between transport, economy and environment[11]. Within the ASTRA model, the linkages between the transport sector and the economy are simulated within the macroeconomic module (MAC), which is built as a demand-supply interaction model. In the short run the demand side is dominating (Keynesian approach) while in the long run the supply side determines the path of development (revised Neo-classical approach). The macro-economic module of ASTRA includes also the effects of taxes and pricing policies on disposable income. Furthermore, transport pricing and taxes make also transport a more expensive input within the I-O table, thus affecting the whole economy. Private and public investments are modelled separately in ASTRA and the model takes into account the existence of a *crowding-out* effect of public investments. Therefore, public investments can have positive macroeconomic impacts, due to the multiplier effect, but also negative ones, as they reduce private investments and disposable income. In other words, the net results of public expenditure and taxes is not defined in advance but depends on the intensity of the multiplier effects and of the crowding-out for the specific policy implemented. Thanks to this structure, the ASTRA model is able to simulate a wide range of impacts of transport measures within a complex dynamic structure of links between transport and the economy. Indirect environmental effects of transport policy are not simulated in ASTRA. For instance, if a pricing policy reduces traffic and air pollution and reduces the number of working hours lost for illness, this is not recognized in the model.

In the ASSESS project the most recent version of the ASTRA model, developed for the LOTSE project (IWW and TRT, 2004), has been then applied to assess the economic impacts of the three modelling scenarios developed in WP3 (Partial, Full and Extended). In addition to the three scenarios, additional sensitivity analysis has been carried out.

The results of the assessment are moderately positive: all the scenarios show an improvement, although in some cases very limited of the main macroeconomic (see table below, where results are shown in terms of absolute difference between yearly growth rates of GDP and employment in the period 2000 – 2020) with respect to the Null scenario.

[11] LOTSE - Quantification of technological scenarios for long-term trends in transport. JRC – IPTS Seville

Figure 14: ASTRA results: absolute difference between yearly growth rates with respect to the Null scenario

	GDP			Employment		
Scenarios	**EU25**	**EU15**	**NMS10**	**EU25**	**EU15**	**NMS10**
Partial	0.047	0.047	0.044	0.024	0.026	0.022
Full	0.080	0.081	0.066	0.040	0.044	0.028
Extended	0.100	0.100	0.093	0.049	0.053	0.039

ASTRA model

To understand the size of the effects one can take into account that a difference of 0.1 in the yearly growth rate leads to a 2% higher GDP at 2020.

Impacts on GDP and employment are higher for the Extended scenario, while the Partial scenario is the one with more limited macroeconomic impacts, and the Full scenario is in between. As the main feature of the Extended scenario is the full implementation of the infrastructure charging (with a correspondent reduction of direct taxes) the better performance of this scenario can be explained by a more efficient distribution of resources between private and public consumptions, due to the introduction of pricing policies together with the reduction of direct taxes.

In general, the size of the increments is small, although it should be remarked that the main objective of the White Paper is not economic development per se, rather the increase of the general welfare of European citizens. Therefore, largely positive macroeconomic impacts were not expected. In brief, the simulations made with the ASTRA model suggest that implementing the measures of the White Paper is positively affecting the EU economic growth, particularly when marginal effects can be detected, although the impacts are quite small.

The sensitivity tests carried out suggest that: a) the option of using the additional revenues from infrastructure charging to finance the TENs projects instead than reducing direct taxes does not change significantly the final effect on economy; b) investments without accompanying policies are not able to stimulate economic growth, due to the crowding out effect; c) in the longer term speeding up vehicle innovation through a support to private investments in the automotive industry can have slightly positive effects.

A further sensitivity scenario has been run to test the effect of a different version of the Partial scenario (called Partial-B scenario), defined at the very end of the project, where infrastructure charging has been quantified according to current tolling and the Eurovignette directive and where measures concerning the harmonisation of checks and penalties on road freight transport have been considered as not having a significant effect on the road freight costs. In brief, road freight costs grow less in Partial-B scenario. The results of the simulation are in line with the other scenarios: the difference with respect to the Null scenario is little but positive, the impact on GDP and employment growth is slightly better than in the original Partial scenario, as the transport costs are lower.

The graphs below show the baseline GDP and employment and the additional GDP and employment due to the White Paper measures.

Figure 15: Baseline GDP and additional GDP for 4 scenarios, EU25, 2000-2020, 2000 = 100

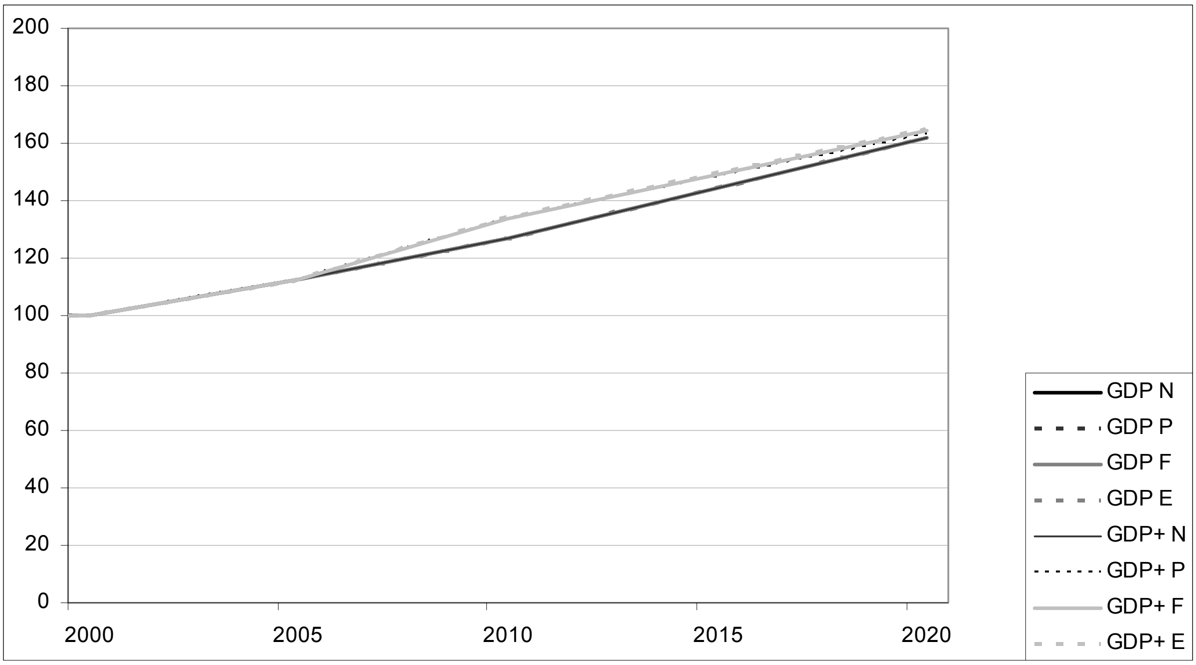
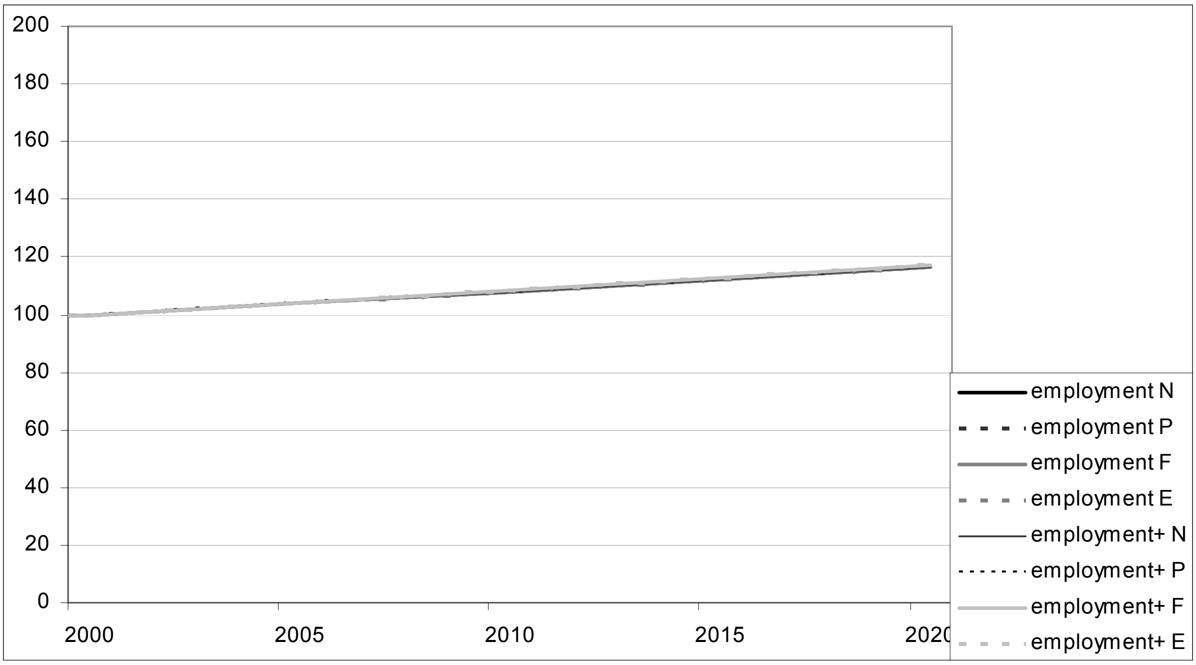


Figure 16: Baseline employment and additional employment for 4 scenarios, EU25, 2000-2020, 2000 = 100



XVII.9. Impact on fair spatial distribution of economic impacts

For this study the results of the CGEurope model have been evaluated using two cohesion indicators (see Annex VIII), the coefficient of correlation of impacts and reference GDP/capita and the Gini-coefficient for each scenario in the years 2010 and 2020[12]. The results for 2010 show that for all three scenarios the effects on cohesion tend toward a slightly more unequal distribution by both indicators, with regions where we observe above average negative impacts as well in the periphery as well as in the centre of Europe. However, cohesion indicator values are rather low, not more than 0.3, so this relationship cannot be considered as strong. The conclusion is confirmed using the Gini-coefficient, which increases only in the forth digit of the value, again, a confirmation that the distribution of GDP/capita is only marginally moved towards a more unequal distribution.

In general the overall effects of the three scenarios as calculated by the CGEurope model are, which was to be expected, as transport costs by region pair in general tend to rise in the three scenarios in comparison with the reference scenarios. The mechanism is that taking the transport cost alone provides a disbenefit, however the effects as shown can be interpreted as the pure result of transport policy (i.e. to observe the most important result for which the policy was designed). Especially for assessing pricing policies it is important to include possible refunding of revenues. However, besides the negative impacts as on GDP, i.e. of pricing, there are also positive impacts on GDP such as investment in infrastructure. In table 1 we have summarized the results for the three scenarios from CGEeurope (see annex report VIII) for the following country groups: EU-15, the new Member States, and the enlarged EU-25 as a whole. Table 1 and present the combined results from the positive and negative effects on GDP as resulting form the White Paper policies in respectively 2010 and 2020.

Table 32: Overall impacts on GDP in the year 2010 in per cent of GDP in 2010 CGEurope, relative to the Null scenario

	Partial	Full	Extended
EU-25	-0.25	-0.29	-0.40
EU-15	-0.25	-0.29	-0.40
NMS-10	-0.19	-0.20	-0.32

Table 33: Overall Impacts on GDP in the year 2020 in per cent of GDP in 2020 CGEurope, relative to the null scenario

	Partial	Full	Extended
EU-25	-0.34	-0.40	-0.62
EU-15	-0.35	-0.41	-0.63
NMS-10	-0.22	-0.29	-0.44

Also with CGEurope an evaluation of only TEN investment was carried out (see main report). When for 2020 only the investment in infrastructure, TEN and TINA projects, is evaluated then the results are:+0.32% of the GDP forecast for 2020 for the whole EU-25, the effect for the old Member States is +0.32% and for the 10 new Member States it is +0.68%. In the extended scenario the negative impact of pricing can be estimated by subtracting these from the extended scenario in the table above. For the EU25 the result of pricing only is given in the table below. In this way we have made clear what the magnitude is of the positively influencing factors on GDP (accessibility improving, i.e. infrastructure investment) and negative factors (accessibility decreasing factors, i.e. SMCP).

[12] For the IASON study a set of five indicators has been used, of which the most normally tend in the same direction.

Table 34: Comparison SMCP/TEN and TEN only, leading to estimation of the negative impact of SMCP

	Extended scenario - policy pricing only
EU-25	-0.94 (= -0.62 - 0.32)
EU-15	-0.95 (= -0.63 - 0.32)
NMS-10	-1.12 (= -0.44 - 0.68)

These numbers do not mean that the effect of the transport policy packages analyzed in the three scenarios is after all negative. These results are just the indirect effects on consumers and producers. What is not taken account of is the revenue of social marginal cost pricing that is included in each scenario and the investment, but also other effects such as change in employment and other markets. Nor are the welfare gains due to improved environment or reduced competition accounted for. Therefore, one has to weigh these negative impacts against the revenues. Furthermore, if one wants to make a full cost-benefit analysis, these impacts have to be weighed against the reduction of negative external effects, such as noise, pollution, congestion, and traffic fatalities.

XVII.10. Car ownership

This chapters gives an overview of the evolution of car ownership in Europe.

XVII.10.1. EU15

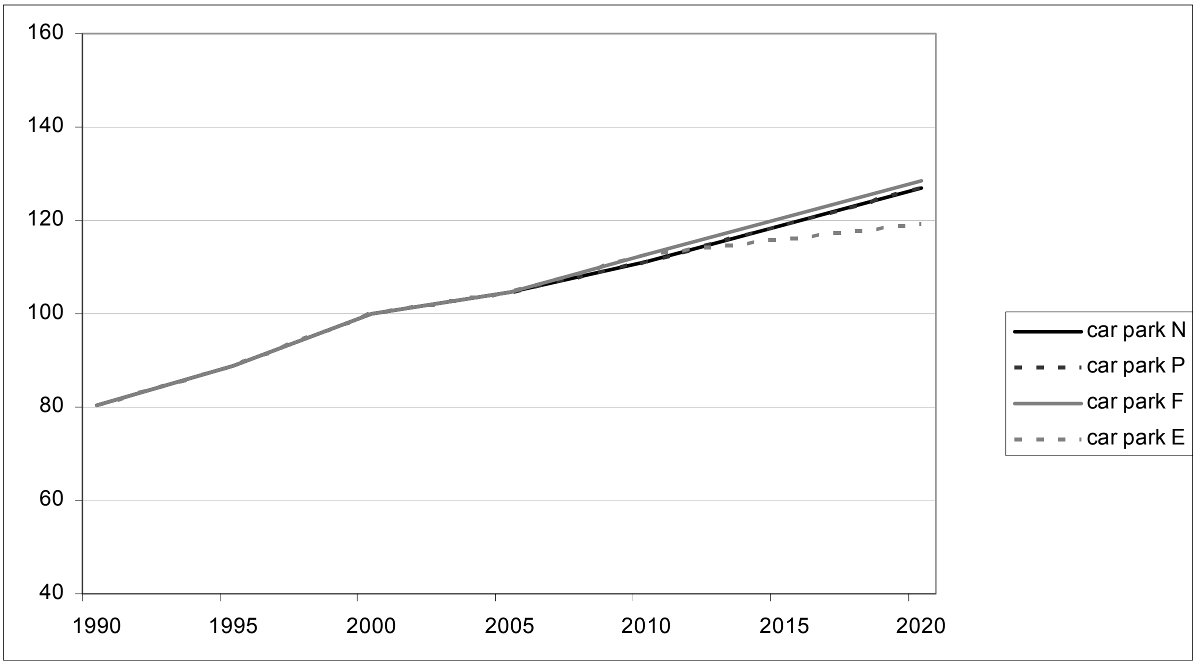
According to Eurostat, the number of newly registered passenger cars increased by 12 % to 14.6 million from 1990 to 1999, an annual average increase of 1.2 % per year. The average annual growth rate of the whole passenger car fleet in the EU was 2.1 % per year between 1990 and 1999. This means that the passenger car fleet grew more rapidly than new vehicles were registered.

Consequently, the penetration rate of new technologies is slowing. Increasingly tight regulations have resulted in the gradual introduction of more fuel-efficient, less polluting, less noisy and generally safer road vehicles. The average age of the vehicle fleet is therefore an indirect indication of the environmental performance of road transport. An older vehicle fleet generates more emissions than a younger one, but more rapid vehicle replacement has the disadvantage of increasing the amounts of energy and materials used for vehicle construction, dismantling and recycling. However, the information on the average age of a vehicle fleet alone is not sufficient to assess its overall environmental performance. Information on the lifetime of vehicles would be helpful to complete the picture. In the 1990s, several Member States introduced scrappage schemes to improve the environmental performance of their car fleet: Greece (1991–93), Denmark (1994–95), Spain (1994 until now), France (1994–96), Ireland (1995–97) and Italy (1997–98) (ECMT, 1999).

Portugal has also introduced a scrappage scheme that ran initially for one year, starting 2 December 2000. Such programmes only result in environmental improvements if the new vehicles have emission rates substantially better than older models and if the environmental impact of vehicle construction and dismantling processes is reduced. Directive 2000/53/EC on end-of-life-vehicles (1), adopted on 18 September 2000, provides that vehicles coming on to the market after 1 January 2005 should be reusable and/or recyclable to a minimum of 85 %, and reusable and/or recoverable to a minimum of 95 %, both in terms of weight per vehicle. The directive thus aims at reducing the environmental impact of the dismantling process, facilitating the replacement of obsolete vehicles without placing high pressure on the environment.

It is expected that the trend will continue towards 2020.

Figure 17: Car park for 4 scenarios, EU15, 1990-2020, 2000 = 100



Source: TREMOVE (from 2000) and Eurostat (before 2000).

XVII.10.2. new Member States

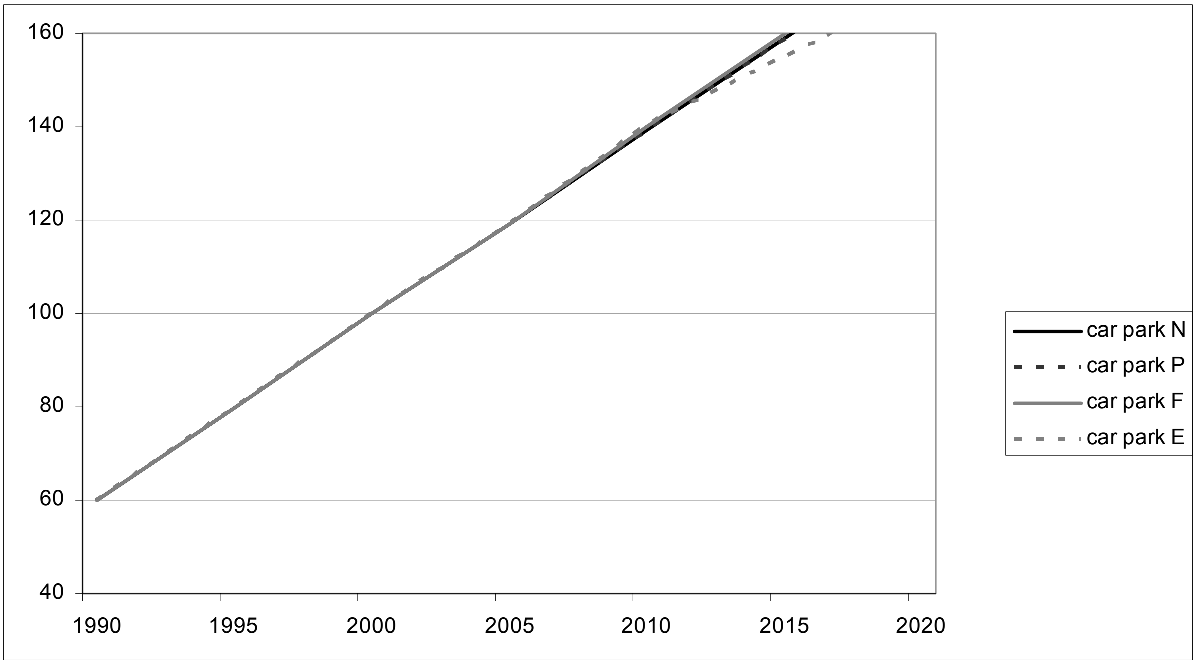
The figures below shows the changes in the number of cars and trucks.

An increasing trend in car ownership can be observed in almost all countries, except Estonia. The level of private motorization differs in individual countries - it is high in Slovenia and Czech Republic (respectively 458 and 357 cars per 1000 inhabitants). Lower figures for Slovakia - 247 cars per 1000 inhabitants, Hungary – 249 cars per 1000 inhabitants and Latvia- 264 cars per 1000 inhabitants.

For trucks, there has been a moderate increase in all countries (except Estonia). The highest rates of growth are 9% in Poland and Czech Republic, and 7% in Slovenia. In other countries the growth rate is between 3-6%. In Estonia a slight decline is noted;

Estimations to 2020 continue that trend.

Figure 18: Car park for 4 scenarios, NMS10, 1990-2020, 2000 = 100

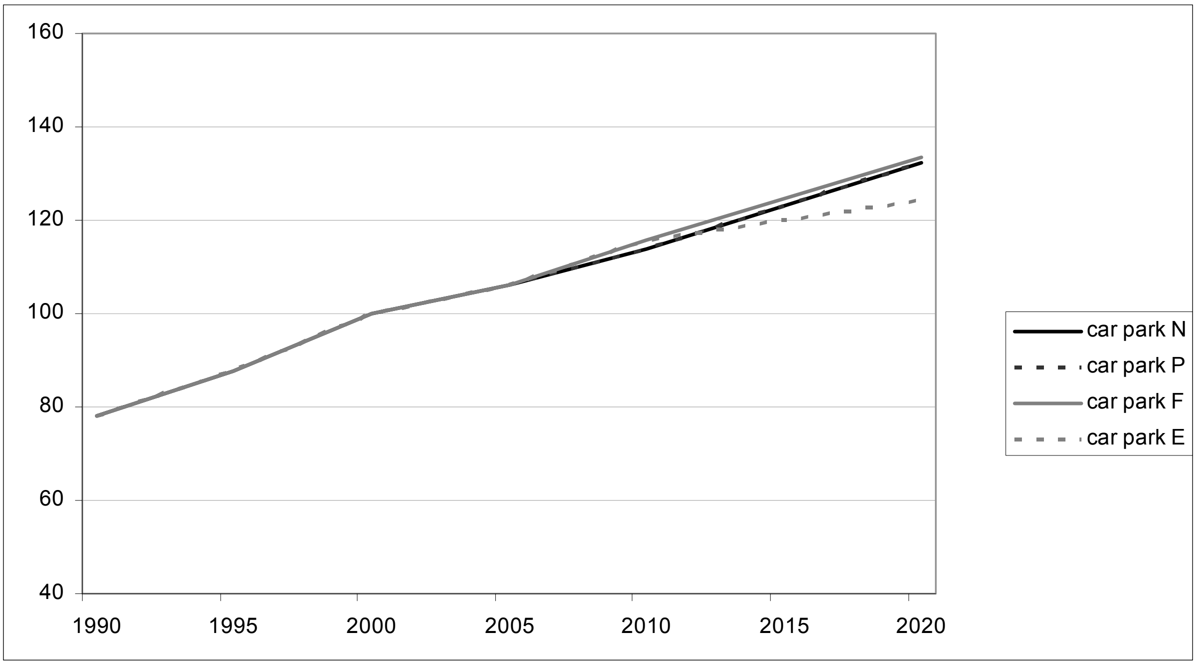


Source: TREMOVE (from 2000) and Eurostat (before 2000)

XVII.10.3. Overview for EU25

The figure below gives an overview of the evolution of the car park and truck park for 1990-2020, for EU25.

Figure 19: Car park for 4 scenarios, EU25, 1990-2020, 2000 = 100



Source: TREMOVE (from 2000) and Eurostat (before 2000)

XVII.11. Road safety

XVII.11.1. Road safety in Europe from 1980 up to now

The number of accidents involving fatalities for EU25 are obtained from the International Road Traffic and Accident Database and TIF table 3.7.1.

For all countries, there was a clear trend towards a decrease of fatalities in 1980-2003.

In 2004, the number of fatalities in Europe decreased more than usual. For some large countries the decrease was very substantial (Spain: -12%), France (-8%), some smaller countries had even better results (Netherlands –19%, Denmark –15%). This overall decrease is of course promising. Unfortunately the 2004 results are not available for all countries.

In the new Member States, the number of fatalities in the period 2000-2003 seem to be stabilising around 11.000. The year 2004 again looks promising, with an decrease of fatalities. The highest decline is observed in Estonia – 27%, Slovenia 10% and 7% in Hungary, the lowest one is noted in Poland 3% and 5% in Latvia, only in Czech Republic and Lithuania was there a slight increase about 1%.

Table 35: Number of rad fatalities in Europe, 1980-2003

	1980	1990	1995	1996	1997	1998	1999	2000	2001	2002	2003
AT	2.003	1.558	1.210	1.027	1.105	963	1.079	976	960	956	931
BE	2.396	1.976	1.449	1.356	1.364	1.500	1.397	1.470	1.455		
DE	15.050	11.046	9.454	8.758	8.549	7.792	7.772	7.503	6.997	6.842	6.613
DK	690	634	582	514	489	499	514	498	446	463	
ES	6.522	9.032	5.751	5.483	5.604	5.957	5.738	5.776	5.522	5.347	5.399
FI	551	649	441	404	438	400	431	396	410	415	379
FR	13.672	11.215	8.891	8.541	8.444	8.918	8.487	8.079	8.146	7.655	6.058
GR	1.446	2.050	2.411	2.157	2.105	2.182	2.116	2.037	1.875		
IE	564	478	437	453	472	458	413	415	402	376	
IT	9.220	7.151	7.033	6.688	6.724	6.849	6.633	6.649	6.689	6.736	
LU	98	70	70	71	60	57	58	76	63	62	53
NL	1.996	1.376	1.334	1.180	1.163	1.066	1.090	1.082	1.021	987	1.028
PT	2.579	2.646	2.377	2.394	2.210	2.126	1.995	1.860	1.680	1.675	1.546
SE	848	772	572	537	541	531	580	591	572	532	529
UK	6.239	5.402	3.765	3.740	3.743	3.581	3.564	3.580	3.439	3.581	3.658
EU15	**63.874**	**56.055**	**45.777**	**43.303**	**43.011**	**42.879**	**41.867**	**40.988**	**39.677**		
CY			118	128	115	111	113	111	98	94	97
CZ	1.261	1.291	1.588	1.568	1.597	1.360	1.455	1.486	1.358	1.431	1.447
EE			332	213	280	284	232	204	199	224	164
HU	1.630		1 589	1 370	1 391	1 371	1 306	1 200	1 239	1 429	1 326
LT			672	667	725	829	748	641	706	697	709
LV			611	550	525	627	604	588	517	518	493
MT			14	19	18	17	4	15	16	16	16
PL	6.002	7.333	6.900	6.359	7.310	7.080	6.730	6.294	5.562	5.827	5.640
SI			415	389	357	309	334	313	278	269	242
SK			660	616	788	819	647	628	614	610	
NMS10			**12.899**	**11.879**	**13.106**	**12.807**	**12.173**	**11.480**	**10.587**	**11.115**	
EU25			**58.676**	**55.182**	**56.117**	**55.686**	**54.040**	**52.468**	**50.264**		

Souce: International Road Traffic and Accident Database and TIF table 3.7.1

XVII.11.2. Road safety in 2010 and 2020

In the White Paper, the goal is stated to halve the number of people killed in traffic between 2001 and 2010.

The assessments of the future number of fatalities were carried out in April and May of 2005, using the then available data on the number of fatalities. This was done by the Dutch SWOV institute. An extended analysis of the safety assessment and analysis can be found in Annex XI.

The assessment was part of the midterm review of the Road Safety Action Program (Ecorys, 2005). Data of 2004 was at that moment not yet available. In 2004, the number of fatalities in Europe decreased more than usual. This overall decrease is of course promising. Unfortunately the 2004 results are not available for all countries. Also, the main assessment of the projections of fatalities to 2010 and 2020 is not very sensitive to temporary fluctuations in a single year. We have therefore concluded that the estimated number of fatalities should not be adjusted for the sudden decrease in 2004.

When 2005 proves that the decrease in 2004 indicates a real trend break, this will mean that it will be a lot less difficult to achieve the goal. As for now, we are not convinced that this is the case, and we prefer to be not too optimistic in our assessment of predicted safety.

For the four scenarios used in the estimation of the safety effects, the conclusions are as follows.

XVII.11.2.1. N-scenario: none of the White Paper measures have been implemented.

For this scenario, the predictions of the number of fatalities in 2010 and 2020 are based upon autonomous changes, corrected (in a negative way) for those White Paper measures that have been implemented and effective. Thus, effects of the measures with high or very high likelihood to be implemented are excluded. According to this scenario, the objective of a reduction in traffic fatalities of 50% will not be reached. None of the EU Member States would reach a 50% reduction in 2010 and for some Member States there would even be an increase in fatalities (Slovakia and Czech republic). For the 25 EU Member States the overall predicted relative fatalities for this scenario is 87%.

XVII.11.2.2. Partial and most likely implementation (P-scenario)

For this scenario, the predictions of the number of fatalities in 2010 and 2020 are based upon autonomous changes (including the effects of the measures with high or very high likelihood, see Annex XI) in the relative fatality rate of road users and on changes in mobility rates. The assessment is based on a projection of a time series of the total number of fatalities. This approach is expected to lead to an underestimation of the number of fatalities. The results may therefore be a little too optimistic. (Annex XI.4.1).

According to this scenario, none of the Member States will reach the 50% reduction in 2010. Some states are approaching the objective (Latvia, France, Portugal), whereas Czech Republic still shows an increase in fatalities. For the 25 EU Member States the overall predicted relative fatalities for this scenario is 73%.

XVII.11.2.3. Full implementation scenario (F-scenario)

For this scenario, the predictions of the number of fatalities in 2010 and 2020 are based upon autonomous changes in the relative fatality rate of road users, on changes in the relative fatality rate of road users caused by all measures contained in the White Paper, and on changes in mobility rates. According to this scenario, part of the EU Member States reach a 50% reduction of traffic fatalities. The majority of the Member States still show a prediction of relative fatalities which is higher than 50%, although not to a great extent. The overall estimate for all 25 Member States is 49%, so for the EU as a whole, according to the full implementation scenario, the objective will be reached. However, in this scenario a rather rigorous implementation of (among other things) e-safety (measure 55) is assumed, which is responsible for a large part of the reduction (without measure 55 the reduction of the full scenario would be 25%).

XVII.11.2.4. Extended scenario (E-scenario)

In the E-scenario, the extended scenario, all the measures stated in the White Paper are implemented. Also, additional measures are included in the scenario (e.g. sustainable safe infrastructure in urban and rural areas all over Europe, daytime running lights). According to this scenario, all EU Member States reach the objective of a 50% reduction in 2010. The overall predicted relative fatalities comes down to 30% for all 25 EU Member States.

Although the full implementation and the extended scenario show positive estimates, care should be taken to be too optimistic. Many assumptions were made to come to these estimates. As stated before, the full implementation scenario is not the most likely scenario, and as the extended scenario is based on the full implementation scenario, this scenario is even less likely. Even if the full implementation scenario will not be reality, proposed additional measures are obviously necessary.

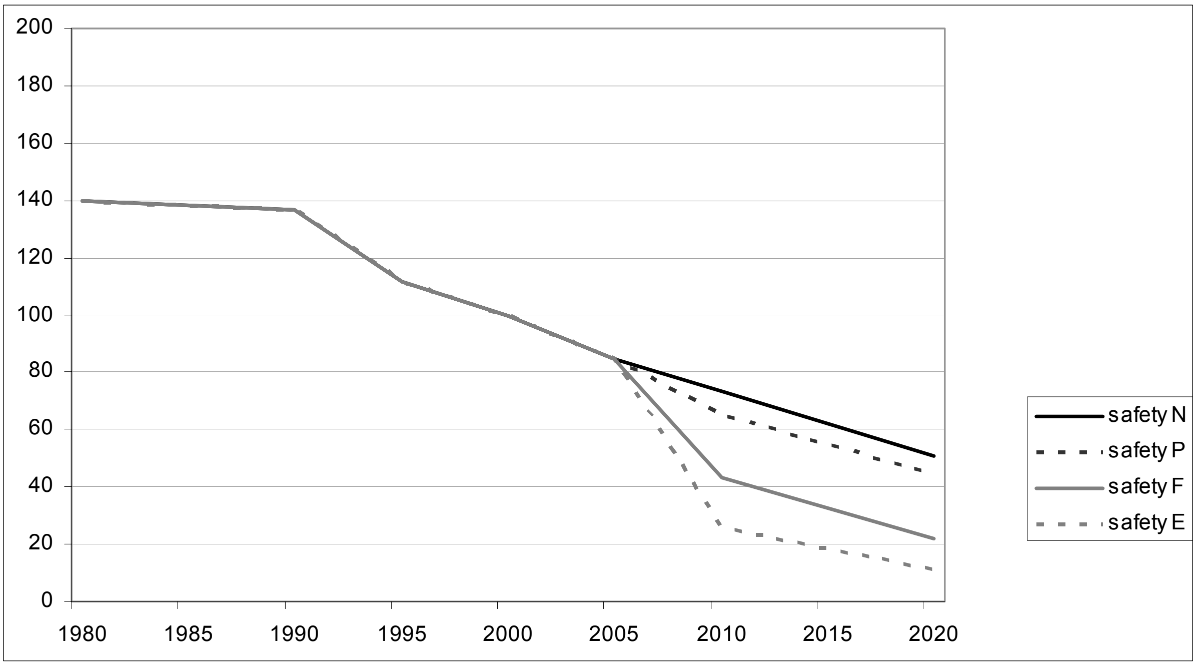
A more realistic estimate would be found for a scenario without measure 55 (e-safety). In our assessment we assumed a far-reaching implementation of e-safety. However, we think this far reaching implementation is unlikely to be fully carried out. A reduction to 40% may be the maximum achievable. This would still ask for vast investments in safe infrastructure. A very rigorous programme might lead to a 50% reduction.

Of course, these estimates are not based on the possibly enduring effect that was seen in 2004 in some countries. Reality may turn out to be (and hopefully will be) more positive than the estimated reduction of fatalities in this report. However, as stated before, we propose to be careful with considering the 2004-results to be absolute and definite. History has proven that a sudden decrease in the number of traffic fatalities may well be followed by a substantial rise in the next year.

XVII.11.3. Concluding graphs

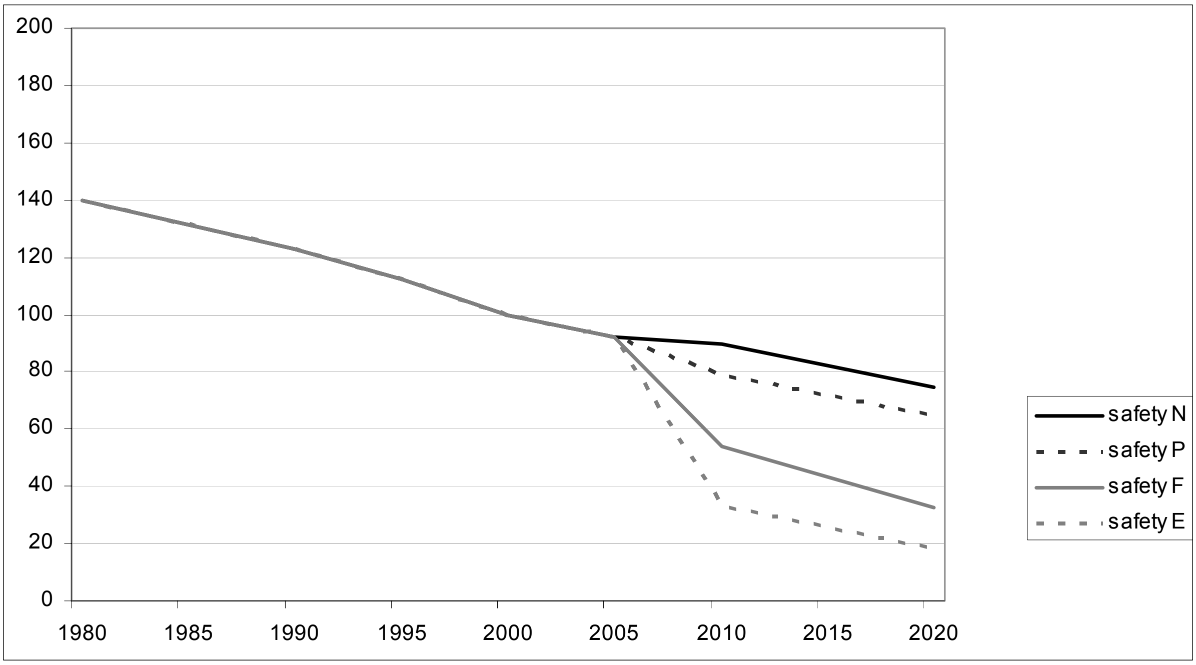
The figures below show the long term trend in road safety, from 1990 up to 2020. The source for the numbers is the analysis in the chapters above.

Figure 20: Road fatalities, EU15, 1980-2020, 2000 = 100



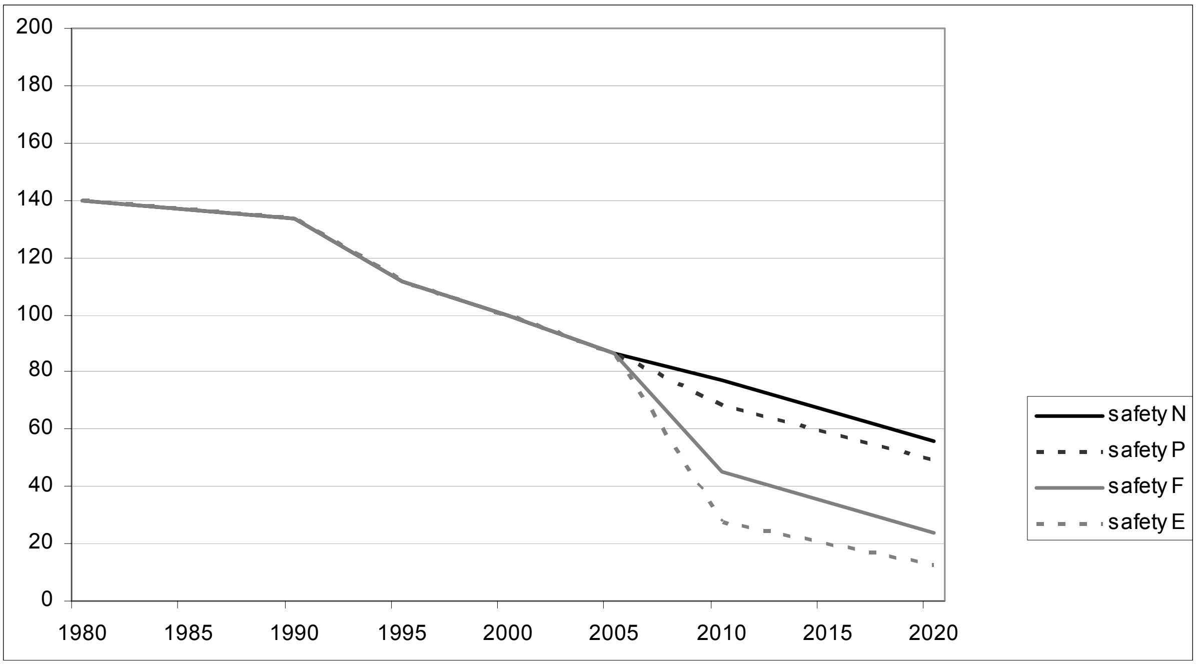
Source: SWOV (projections) and International Road Traffic and Accident Database and TIF table 3.7.1 (historic data)

Figure 21: Road fatalities, NMS10, 1980-2020, 2000 = 100



Source: SWOV (projections) and International Road Traffic and Accident Database and TIF table 3.7.1 (historic data)

Figure 22: Road fatalities, EU25, 1980-2020, 2000 = 100



Source: SWOV (projections) and International Road Traffic and Accident Database and TIF table 3.7.1 (historic data)

XVII.12. Energy consumption

XVII.12.1. TREMOVE model results and analysis

In the EU15 total energy consumption will remain almost stable. The growth in transport activity can be compensated mainly by increases in the fuel efficiency for all road vehicles. However, the expected growth in air traffic emissions – with their higher specific climate impact – risks to offset all improvements for surface transport. In the NMS4 [13], transport energy consumption will increase. The growth in transport activity is much stronger in these countries, and is not offset by the improvements in energy efficiency.

The figures for energy consumption for 2000-2020 are being estimated with the TREMOVE model.

TREMOVE is a transport and emissions simulation model developed for the European Commission Directorate-General Environment. The model estimates the transport demand, the modal shifts, the vehicle stock turnover, the emissions of air pollutants and the welfare level for different policy scenarios. A description of TREMOVE and the TREMOVE model results can be found in Annex VII.

Figure 23 and Table 36 show the total energy consumption in the four scenarios in the EU 15 countries. Similar figures for the 4 new Member States can be found in Figure 24 and Table 37.

The almost constant energy level is a direct consequence of the voluntary agreement of car producers to reduce CO_2 emissions of new cars, as well as of the continuous development of technologies to reduce fuel costs in the road freight sector. However, the voluntary agreement s not a White Paper measure.

A White Paper measure that contributes to an energy reduction is the promotion of clean urban transport, as it leads to an accelerated replacement of older, less fuel-efficient vehicles. Improvements in air transport efficiency, by way of the Single European Sky programme, will not offset the strong increase in air transport activity.

In the new Member States, a stronger growth in both passenger and freight transport is expected. Although similar improvements in efficiency are expected as in EU15, these cannot avoid a strong growth in overall energy consumption in these countries.

The predicted energy consumption for the N scenario is somewhat higher than that for the P scenario. This is in line with the fact that total transport activity, especially for freight, in N is a bit higher than in P.

Compared to the P scenario, total road vehicle energy consumption is higher in the F scenario. The reduction in truck transport caused by the introduction of social marginal cost pricing for road freight leads to a decrease in truck energy consumption, but this does not compensate the increase for road passenger transport. Full implementation of marginal social cost pricing in the freight sector and partial marginal social cost pricing for passenger car and air transport will lead to a significant decrease in the 2020 energy consumption of road and air transport in the E scenario. In the EU15, this policy scenario even is predicted to bend the modest upward trend in transport energy consumption into a decrease.

[13] NMS4 = Poland, Czech Republic, Hungary, Slovenia.

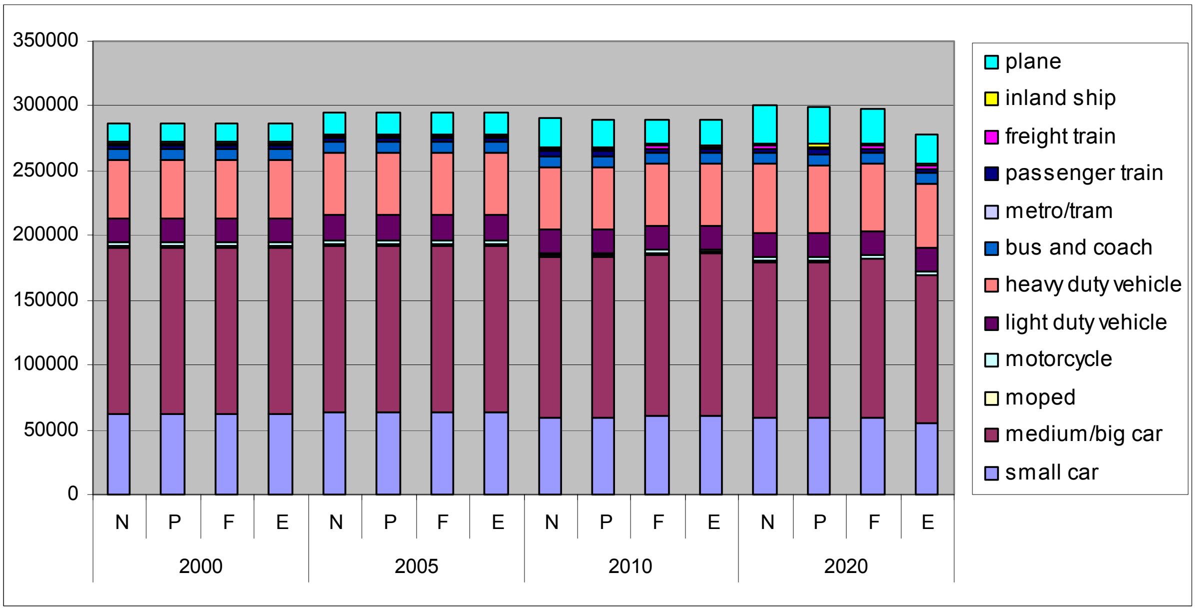


Figure 23 : EU15 Energy consumption by mode and scenario - ktoe

	2000	2005				2010				2020			
		N	P	F	E	N	P	F	E	N	P	F	E
small car	62572	62924	62924	62924	62924	59789	59788	60653	60685	58836	58829	59528	55086
medium/big car	128109	129061	129061	129061	129061	123211	123211	124854	125046	120568	120562	121970	113606
moped	1486	1418	1418	1418	1418	1315	1315	1328	1327	1117	1117	1126	1049
motorcycle	2419	2611	2611	2611	2611	2666	2666	2713	2718	2904	2904	2938	2694
light duty vehicle	18003	19251	19251	19251	19251	17993	17988	18135	18038	18268	18250	18230	17714
heavy duty vehicle	45314	47982	47982	47982	47982	48135	48036	47471	47108	53318	52985	51134	49365
bus and coach	8529	8509	8509	8509	8509	8544	8488	8597	8630	8265	8234	8495	8732
Total road	**266433**	**271756**	**271756**	**271756**	**271756**	**261653**	**261491**	**263750**	**263552**	**263277**	**262880**	**263420**	**248246**
metro/tram	89	90	90	90	90	102	102	103	102	114	114	115	114
passenger train	2777	2839	2839	2839	2839	3231	3259	3193	3157	3436	3532	3397	3519
freight train	1797	1846	1846	1846	1846	1872	1878	1870	1916	2111	2126	2210	2458
Total rail	**4662**	**4775**	**4775**	**4775**	**4775**	**5204**	**5239**	**5166**	**5175**	**5661**	**5772**	**5723**	**6091**
inland ship	1313	1258	1258	1258	1258	1454	1454	1469	1479	1652	1652	1663	1700
plane	14602	17777	17777	16561	16866	21725	21400	18788	18926	29613	28931	26431	22081
TOTAL	***287011***	***295566***	***295566***	***294350***	***294655***	***290036***	***289584***	***289173***	***289133***	***300204***	***299236***	***297238***	***278119***

Table 36 : EU15 Energy consumption by mode and scenario – ktoe

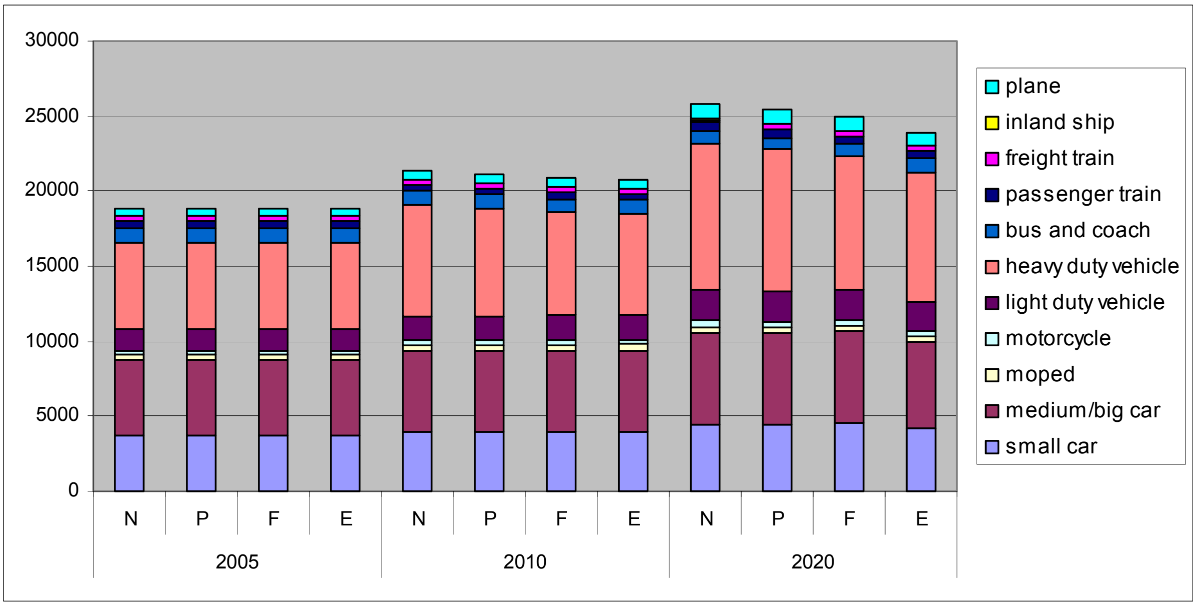


Figure 24 : 4 NMS Energy consumption by mode and scenario - ktoe

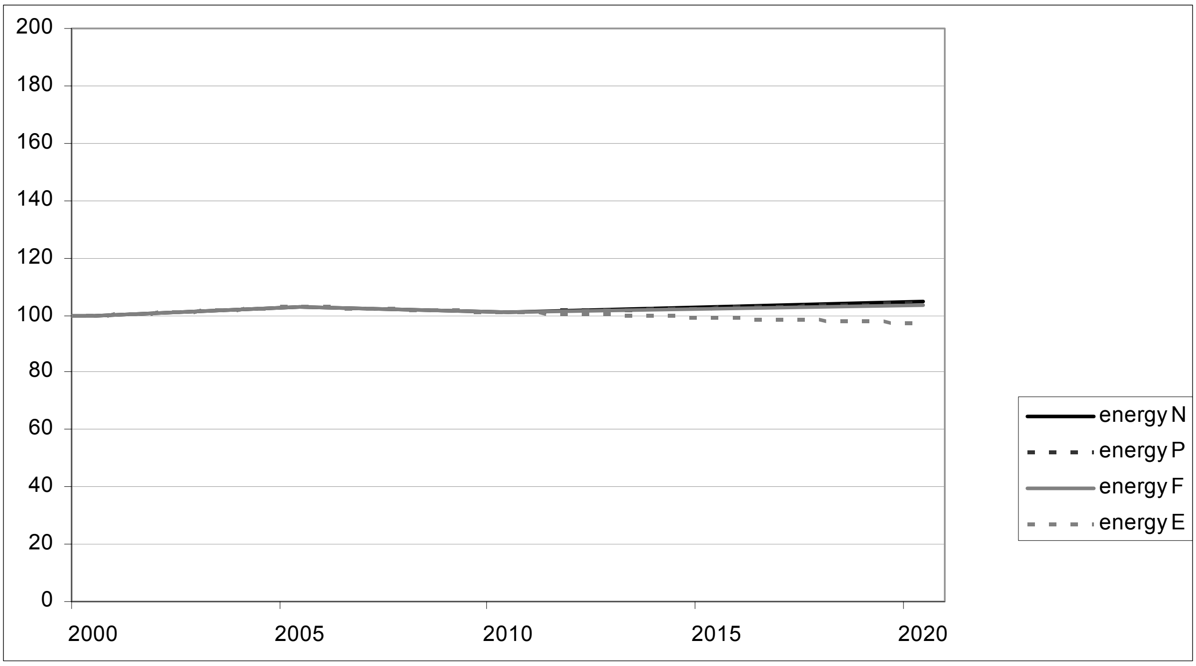
	2005				2010				2020			
	N	P	F	E	N	P	F	E	N	P	F	E
small car	3750	3750	3750	3750	3973	3973	3993	3999	4495	4485	4523	4259
medium/big car	4980	4980	4980	4980	5331	5331	5358	5363	6072	6055	6110	5748
moped	418	418	418	418	424	424	426	426	388	387	390	363
motorcycle	249	249	249	249	309	309	312	314	397	396	400	369
light duty vehicle	1448	1448	1448	1448	1655	1633	1619	1607	2030	1989	1965	1914
heavy duty vehicle	5723	5723	5723	5723	7384	7149	6849	6742	9835	9446	8975	8641
bus and coach	981	981	981	981	937	927	930	939	820	812	831	879
Total road	**17549**	**17549**	**17549**	**17549**	**20014**	**19746**	**19486**	**19389**	**24038**	**23570**	**23194**	**22173**
passenger train	499	499	499	499	444	440	414	422	509	513	422	463
freight train	307	307	307	307	275	313	342	362	230	365	342	375
Total rail	**806**	**806**	**806**	**806**	**719**	**753**	**756**	**784**	**739**	**877**	**763**	**838**
inland ship	24	24	24	24	14	15	15	15	14	14	14	15
plane	466	464	450	452	648	633	590	578	1038	1021	942	857
TOTAL	***18845***	***18843***	***18829***	***18831***	***21396***	***21146***	***20847***	***20767***	***25828***	***25483***	***24914***	***23882***

Table 37 : 4 NMS Energy consumption by mode and scenario – ktoe

XVII.12.2. Summarising graphs

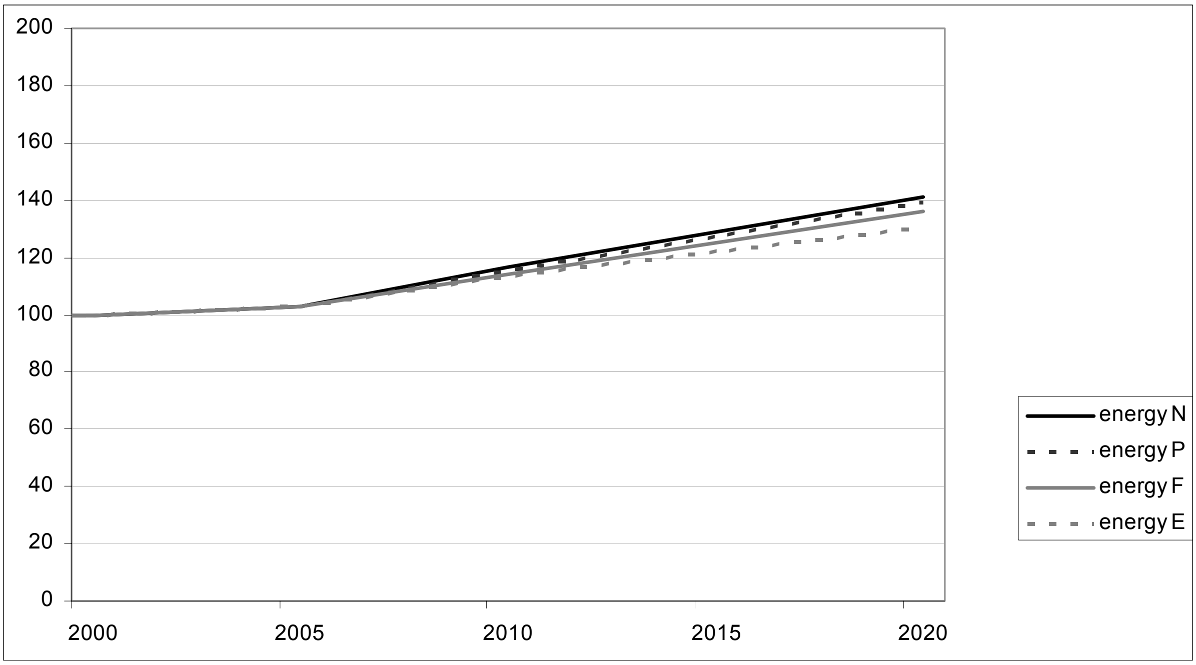
The graphs below give an overview of the energy consumption from transport in Europe for 2000-2020.

Figure 25: Energy consumption in toe, EU15, 2000-2020, 2000 = 100



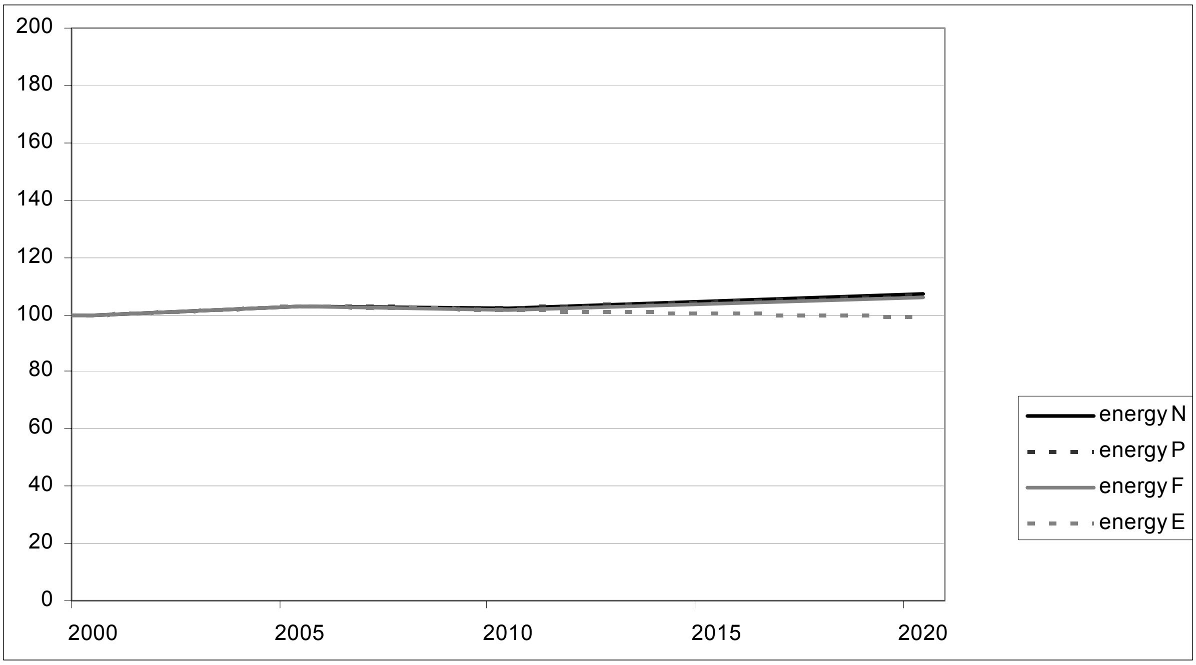
Source: TREMOVE model, see Annex VII.

Figure 26: Energy consumption in toe, NMS10, 2000-2020, 2000 = 100



Source: TREMOVE model, see Annex VII. TREMOVE models only the 4 largest new Member States. The other countries are added – extrapolated on the basis of the population.

Figure 27: Energy consumption in toe, EU25, 2000-2020, 2000 = 100



Source: TREMOVE model, see Annex VII.

XVII.12.3. Efficiency per mode

The table below gives an overview of the energy consumption per unit of activity.

It is clear that car and truck transport consume the most energy per passenger or tonne kilometre. For cars, it also can be denoted that there is a significant improvement in efficiency for 2000-2020.

Table 38: Transport energy consumption: toe per unit acitivity in EU15 (toe per million passenger-km or tonne-km)

	2000	2005	2010 N	2010 P	2010 F	2010 E	2020 N	2020 P	2020 F	2020 E
passengers										
car	48	45	40	40	40	40	34	34	34	35
2-wheeler	26	25	24	24	24	24	22	22	22	22
light duty vehicle	71	69	65	65	65	65	61	61	61	61
bus and coach	21	21	20	20	20	20	20	20	20	20
metro/tram	2	2	2	2	2	2	2	2	2	2
passenger train	9	9	10	10	9	9	9	10	9	9
plane	51	51	51	50	50	49	51	49	48	46
freight										
light duty vehicle	110	107	102	102	102	102	96	96	96	96
heavy duty vehicle	34	33	31	31	31	31	30	30	30	30
freight train	7	7	7	7	7	7	8	8	7	7
inland ship	10	10	11	11	10	11	11	11	11	11

Source: TREMOVE

XVII.12.4. Analysis of the determinants of energy consumption in transport

A further analysis of the components that lead to an almost constant energy consumption is given in the table below. The table shows clearly that the technological component balances out the activity growth. The influence is modal shift is rather modest, and negative. The reason for this is the increase of the truck share in the total tonne-km (both road and rail increase, but road increases faster).

Table 39: Determinants of energy consumption in transport, EU15

Energy consumption increase versus 2000 due to:	2010 N	2010 F	2020 N	2020 F
growth in tonne-km and passenger-km	15,10%	15,55%	31,89%	32,11%
modal shift	0,83%	0,63%	1,79%	1,35%
technological improvement	-13,08%	-13,38%	-22,55%	-22,85%
TOTAL	**1,05%**	**0,75%**	**4,60%**	**3,56%**

A more detailed analysis can be found in the table below.

Table 40: Determinants of energy consumption in transport, EU15 (detailed)

	2000 P	2010 N	2010 F	2020 N	2020 F
Activity by mode - million km					
Car	4.295.687	4.914.540	4.993.143	5.632.630	5.696.922
Bus/coach	401.761	421.855	429.334	413.156	428.480
Train/metro	348.190	394.931	398.023	430.205	435.407
Air	283.610	426.650	376.680	584.559	547.897
Road	1.369.092	1.582.792	1.558.984	1.827.445	1.748.745
Rail	249.528	253.280	260.483	271.283	299.029
Inland Waterway	127.052	137.910	140.131	156.674	157.715
TOTAL	7.074.919	8.131.958	8.156.777	9.315.951	9.314.196
Ktoe by mode TOTAL					
Car	208.893	201.448	204.234	198.290	200.622
Bus/coach	8.529	8.544	8.597	8.265	8.495
Train/metro	2.866	3.332	3.296	3.550	3.513
Air	14.602	21.725	18.788	29.613	26.431
Road	49.011	51.660	50.919	56.722	54.304
Rail	1.797	1.872	1.870	2.111	2.210
Inland Waterway	1.313	1.454	1.469	1.652	1.663
TOTAL	287.011	290.036	289.173	300.204	297.238
growth		1,05%	0,75%	4,60%	3,56%
Ktoe by mode ONLY GROWTH - MODAL SHIFT AND TECHNOLOGY FROZEN FOR 2000					
	208.893	241.377	242.914	276.756	278.643
	8.529	9.856	9.918	11.300	11.377
	2.866	3.311	3.332	3.796	3.822
	14.602	16.873	16.980	19.346	19.478
	49.011	55.421	55.017	63.322	61.921
	1.797	2.032	2.017	2.321	2.270
	1.313	1.484	1.473	1.696	1.658
TOTAL	287.011	330.354	331.652	378.538	379.170
growth		15,10%	15,55%	31,89%	32,11%
Ktoe by mode ONLY MODAL SHIFT - GROWTH and TECHNOLOGY FROZEN FOR 2000					
	208.893	206.825	208.803	206.743	207.686
	8.529	7.751	7.838	6.620	6.819
	2.866	2.813	2.817	2.672	2.686
	14.602	19.011	16.678	22.717	21.148
	49.011	50.108	49.716	50.634	49.550
	1.797	1.613	1.671	1.512	1.704
	1.313	1.260	1.290	1.253	1.290
TOTAL	287.011	289.379	288.813	292.152	290.884
growth		0,83%	0,63%	1,79%	1,35%
Ktoe by mode ONLY TECHNOLOGY - GROWTH AND MODAL SHIFT FROZEN FOR 2000					
Car	208.893	176.081	175.706	151.225	151.276
Bus/coach	8.529	8.137	8.044	8.037	7.965
Train/metro	2.866	2.938	2.884	2.873	2.809
Air	14.602	14.441	14.146	14.367	13.682
Road	49.011	44.685	44.717	42.495	42.514
Rail	1.797	1.844	1.791	1.942	1.844
Inland Waterway	1.313	1.340	1.332	1.340	1.339
TOTAL	287.011	249.467	248.620	222.279	221.430
growth		-13,08%	-13,38%	-22,55%	-22,85%

XVII.13. Climate change

XVII.13.1. TREMOVE model results and analysis

Overall, the transport sector shall contribute to achieve the commitment of the European Union according to the Kyoto agreement[14], namely to reduce its greenhouse gas emissions by 8% in the period 1990 to 2008/2012.

Despite the growth in transport, CO_2 emissions[15] from only grow modestly from 2000 to 2010 and 2020. It seems however out of reach, that emission go down on an average 8% over the period. This would need major efforts.

Progress depends to a large degree on improvements for car transport and a containment of road freight emissions. However, the expected growth in air traffic emissions – with their higher specific climate impact – risks to offset all improvements for surface transport.

The stableness of the transport emissions is due to the fact that the transport activity growth will be compensated mainly by increases in the fuel efficiency for all road vehicles, through dieselisation of the fleets as well as through genuine technology improvements. For cars, the latter improvements are driven by the voluntary agreement of the car industry to reduce CO_2 emissions of new cars. Also the Single European Sky policy – compensation for a part the large air transport growth –, as well as the accelerated replacement of older urban busses contribute to this stabilisation of CO_2 emissions. The small increase of CO_2 emissions for the freight sector is, compared to passenger transport, explained by the stronger growth in freight transport and the lower expectations for future fuel efficiency improvements for trucks (compared to cars). In the NMS4, CO_2 emissions will increase. The growth in transport activity is much stronger in these countries, and is not offset by the improvements in energy efficiency.

The differences in transport flows between the N and P scenarios are limited, except for the increase in freight rail transport which leads to an increase in freight rail emissions. The main other effects on emissions in the P scenario, compared to N, are a reduction in aircraft emissions resulting from the European Sky Programme and a decrease in bus emissions due to the accelerated introduction of cleaner busses. None of these effects lead to a significant change in total CO_2 emissions from the transport sector.

However, in the P scenario it is also expected that the 5.75% (2010) and 8% objectives on biofuel penetration are reached. This leads to a 6% CO_2-gain in the EU15 states by 2020, as well as a significant reduction of the CO_2 growth in the new Member States.

The F scenario is characterised by a lower tonne-km growth and a higher passenger-km growth than the P scenario. The net result, compared to P, of these effects is a very small increase in CO_2-emissions.

As for energy consumption, 2020 road and air CO_2 exhaust emissions in the E scenario show a significant decrease compared to the other scenarios, which is only partially compensated by an increase for rail and inland waterway. This policy scenario would even lead to a reduction of CO_2 exhaust emissions of about 5%, without accounting for the introduction of biofuels (which gives an extra 6% gain).

[14] Although the Kyoto agreement is mentioned once (p. 22) in the White Paper, it is not a specific White Paper objectives.

[15] Both exhaust as life cycle (well to wheel) emissions.

The figures below show the different components of the CO_2 emissions: the exhaust emissions and the well-to-wheel emissions. For the well-to-wheel component, a variant with and without the biofuel policy is shown.

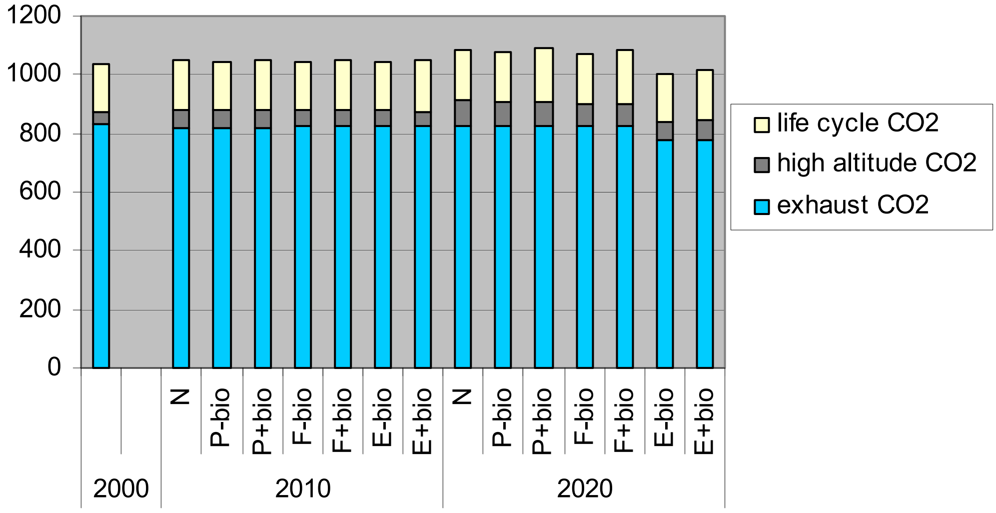


Figure 28 :EU15 CO_2 emissions by scenario, in million tonnes

Source: TREMOVE

Life cycle: well-to-wheel emissions

High altitude: air transport emissions

-/+ bio: excluding or including the biofuel policy

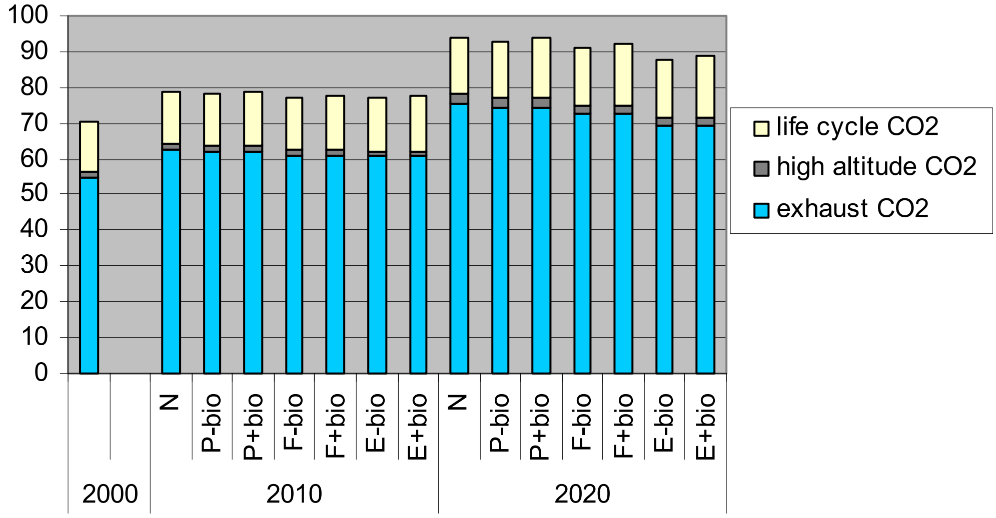


Figure 29 : NMS4 CO_2 emissions by scenario, in million tonnes

Source: TREMOVE

Life cycle: well-to-wheel emissions

High altitude: air transport emissions

-/+ bio: excluding or including the biofuel policy

XVII.14. Emissions and air quality

XVII.14.1. TREMOVE model results and analysis

Although TREMOVE also includes calculations for pollutants as CO and volatile organic compounds (as methane and benzene), the discussion in this section is restricted to the pollutants considered to be most relevant in this project, i.e. NO_x, particulates (PM) and SO_2. Information on the other pollutants is available in the TREMOVE output tables.

It should be recalled that most of environmentally relevant actions of the EU, notably effective in reducing CO_2 and pollutant emissions from road vehicles, is outside explicit White Paper measures.

The figures below show the predicted evolution of vehicle exhaust emissions in the 4 sceanrios relative to the year 2000 levels, for NO_x, particulates (PM) and SO_2. The major driver for the EU15 reduction in NO_x and particulate emissions is the introduction of road vehicles complying to the most recent emission standards (EURO IV for cars and EURO V for trucks). For busses the policy promoting a faster introduction of clean vehicles of course accelerates this effect. The impact of the new emission standards on particulate emissions is to significant extent hampered by the rising share of diesel cars in the fleet, resulting in a stronger decrease in freight PM emissions than passenger PM emissions. NO_x emissions from passenger road transport decrease stronger then those from freight road transport however. For air transport the reduction of flight route lengths for aircrafts compensates to a certain extent the strong growth for this mode, but it is only a small step towards the general objective on reducing emissions from air transport. Similar to CO_2, the decrease in emissions is more modest in the new Member States due to the stronger growth in activity.

SO_2 emissions decrease strongly in the 2005-2010 period, this is in first place the result of the introduction of low(er) sulphur fuels in the road transport sector. In later years the emission levels follow the growing activity levels.

Figure 30 : EU25 total PM emissions for all modes (2000 = 100)

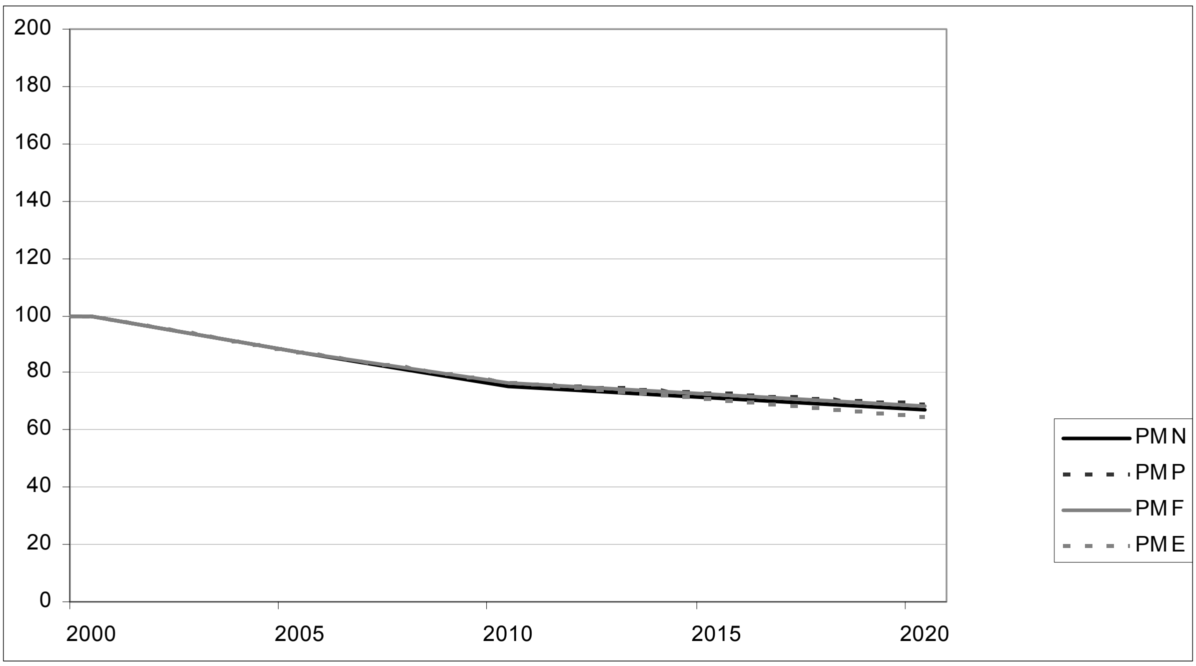


Figure 31 : EU25 total NOx emissions for all modes (2000 = 100)

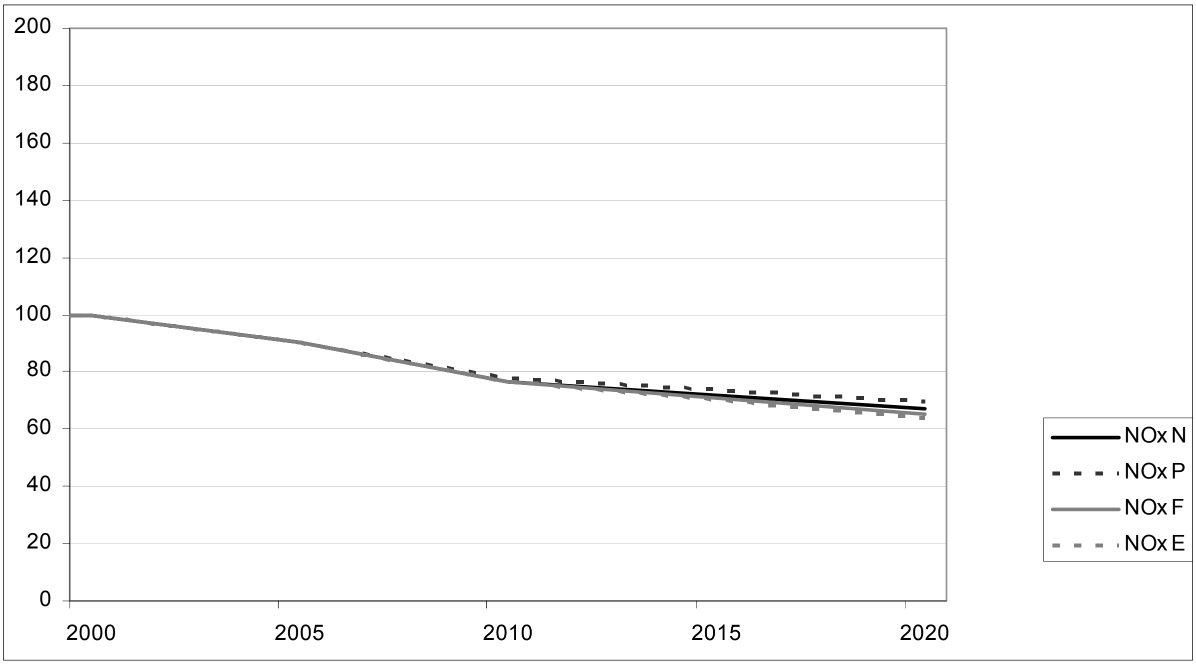
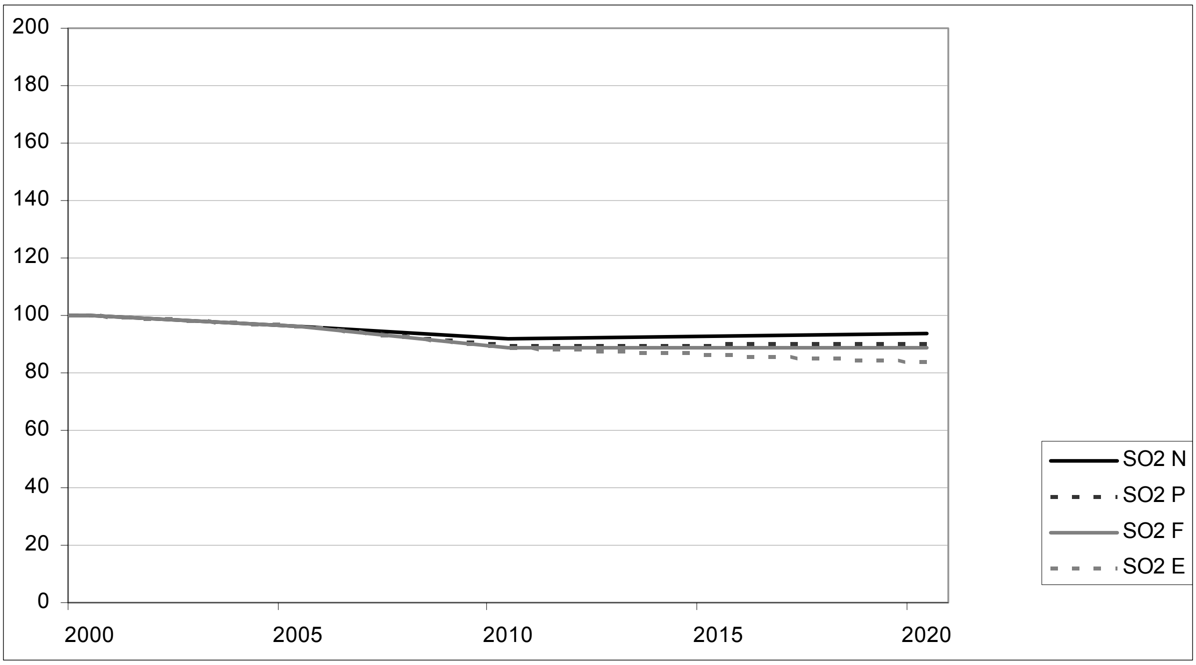


Figure 32 : EU25 total SO2 emissions for all modes (2000 = 100)



The differences in transport flows between the N and P scenarios are limited, except for the increase in freight rail transport which leads to an increase in freight rail emissions. The main other effects on emissions in the P scenario, compared to N, are a reduction in aircraft emissions resulting from the European Sky Programme and a decrease in bus emissions due to the accelerated introduction of cleaner busses. Overall, none of these effects lead to a significant change in total emissions from the transport sector.

The F scenario is characterised by a lower tonne-km growth and a higher passenger-km growth than the N and P scenarios. This results mainly in a decrease in truck emissions and an increase in private transport emissions (car, two-wheelers). The net result, compared to N and P, is a decrease for NO_x and PM. Focussing at rail transport, the dialogue with the rail industry leads to a significant decrease in rail exhaust emissions, notably for NO_x and SO_2 emissions. Note that part of this positive effect will be compensated by increases in electricity consumption and a related increase in lifecycle emissions, i.e. in the emissions from electricity power plants. This latter effect is discussed in more detail in annex VII to this report. As rail has only a modest share in total transport, the effect of the rail improvements on total transport exhaust emissions is very limited.

XVII.14.2. Emissions efficiency per mode

The tables below show the emissions per unit of transport activity for CO_2, NO_x, particulates (PM) and SO_2.

Table 41: Emissions per unit acitivity for EU15 (ton per million passenger-km or tonne-km)

	CO_2 (g/km)			PM (kg/km)			NOx (kg/km)			SO_2 (kg/km)		
	2000	**2010**	**2020**	**2000**	**2010**	**2020**	**2000**	**2010**	**2020**	**2000**	**2010**	**2020**
PASSENGERS												
small car	160	135	116	24	22	20	817	287	175	264	206	173
medium/big car	183	155	132	50	35	28	660	365	261	284	214	179
moped + motorcycle	96	89	80	87	87	86	176	219	239	159	137	121
light duty vehicle	254	237	222	145	85	56	1.307	960	727	372	309	286
bus + coach	75	72	72	42	24	14	858	494	280	104	86	84
metro/tram	8	6	7	1	0	0	14	6	4	31	5	2
passenger train	37	34	35	17	13	11	269	208	175	109	41	30
plane	165	164	163	14	14	14	533	524	519	195	193	193
FREIGHT												
light duty vehicle	393	370	349	224	133	88	2.024	1.498	1.143	577	482	450
heavy duty vehicle	121	112	108	68	34	20	983	544	290	167	134	127
freight train	28	27	30	11	10	9	166	153	138	70	30	25
inland ship	37	37	37	44	45	45	638	648	649	80	81	81

Source: TREMOVE

Emissions include both exhaust and well-to-wheel. The years 2010 and 2020 are in the partial scenario case.

The air quality emissions improvement for road transport is due to the Euro standards. The improvement in energy efficiency fro cars is due to the ACEA agreement.

For trucks, there is also an efficiency improvement, due to the fact that transport companies have an increasing strong demand for fuel efficient trucks (lower costs) among others due to the increase of oil prices. Busses have the same engines as trucks and therefore also profit from this. Busses tend to be relatively older, so the improvement only visible in the vehicle park at a slower rate.

For sulphur, inland ships have the highest exhaust emissions, due to the high sulphur content of the ship fuel. But road transport also emits a lot of sulphur, not at the exhaust but at the refinery plant, in that magnitude that it ends up with more sulphur per tonne-km than inland shipping.

XVII.15. Noise

Data on noise exposure or annoyance are scarce on the European level. Due to its strong relation with the traffic volume the situation however changes only slowly. Therefore data for the late 90'ies do appropriately indicate the scale of the nuisance: "About 120 million people in the EU15 (more than 30 % of the total population) are exposed to road traffic noise levels above 55 Ldn dB. More than 50 million people are exposed to noise levels above 65 Ldn dB. It is estimated that 10 % of the EU population are exposed to rail noise above 55 LAeq dB. The data on noise nuisance by aircraft are the most uncertain, but studies indicate that 10 % of the total EU population may be highly annoyed by air transport noise" (EEA 2001)[16].

Environmental noise, among which traffic noise is often perceived as highly disturbing, is considered a nuisance or health risk. Its monitoring and reduction are part of the overall EU policy (DIR 2002/49/EC) but has not been addressed by explicit measures in the Transport White Paper, except for aircraft noise. Hence the estimates of noise exposure and related noise annoyance differ between the modelled scenarios only to the extent that the increase in traffic volumes differs. The composition of the vehicle fleet running in urban areas, i.e. the mix of less noisy passenger cars and light duty vehicles on the one hand and the noisier heavy duty vehicles on the other hand, does not so differ much between the scenarios that reliable and sizeable differences in noise could be inferred: A sizeable reduction of the average traffic noise level, i.e. by about 2-3 dB(A), would need a reduction of the traffic volume by about a factor of 2, all other parameters equal. The traffic volume estimates in the various scenarios differ however only by a few percent (cf. Table 42).

Table 42: Estimates of traffic volume growth in urban areas (vehicle kilometres) for the different scenarios relative to 2005 (2005 = 100)

Vehicle Type	Network	2010N	2010P	2010F	2010E	20210N	2020P	2020F	2020E
passenger cars	urban	108%	108%	110%	110%	126%	126%	127%	119%
light duty	urban	106%	106%	107%	107%	120%	120%	121%	116%
heavy duty	urban	90%	90%	88%	89%	88%	88%	85%	84%
trains	rail	107%	108%	108%	108%	117%	119%	120%	127.5%

(Source: Annex X, Table 2)

As a consequence, the noise exposure and annoyance of the population is set to increase in all scenarios with only relatively minor differences between them. This is illustrated by the case study of Amsterdam, where the traffic growth estimates of the scenarios, differentiated by vehicle category, was translated into estimates of the highly annoyed population shares by road and rail. Virtually all estimates coincide, with road traffic remaining about 10 times more annoying than rail transport (Table 43). Taking both road traffic noise and rail traffic noise into account, the extended scenario gives the lowest increase in the number of people being highly annoyed.

[16] EEA 2001: TERM fact sheet "Traffic noise: exposure and annoyance"

Table 43: Expected percentage of highly annoyed (%HA) due to road traffic and rail traffic in the different scenarios in the population of the Netherlands.

	%HA Road	*relative to 2005*	*%HA Rail*	*relative to 2005*
2005N	4.49%	100%	0.51%	100%
2010N	4.64%	103%	0.54%	106%
2010P	4.63%	103%	0.55%	106%
2010F	4.67%	104%	0.55%	106%
2010E	4.66%	104%	0.55%	106%
2020N	4.98%	111%	0.58%	113%
2020P	4.98%	111%	0.59%	114%
2020F	4.99%	111%	0.59%	115%
2020E	4.82%	107%	0.61%	120%

(Source: Annex X, Table 4)

In this approach, the volume changes are assumed to take place on the existing network and the route choice is assumed to be unchanged. No noise abatement measures were taken into account nor technical improvements of the vehicle fleet as these are outside White Paper measures. Therefore, the increased annoyance may be due to either higher exposure levels along already busy and hence noisy routes or more widespread exposure due to increased traffic at previously less frequented routes. Reductions of vehicle specific noise emissions may help to cap maximum noise levels and events, particularly when targeted at the noisiest vehicles - (older) lorries, motor-cycles, trams, freight trains - applied during sensitive times - night intervals - or in sensitive areas. Large scale improvements can however only be expected when the traffic volume is controlled.

Air traffic

With respect to air traffic noise a particular aim of the White Paper is 'to compensate for the increase in air traffic by reducing aircraft noise by 10 dB in order to cut the perceived noise level by 50 %.' There has been no quantitative information available to model the potential impact (cf. Annex X). Crucial for the noise exposure and annoyance are landing and taking around airport. Improvements have been made in the past, notably also by a noise sensitive landing procedure and noise differentiated landing charges, which increased the phase-out or renewal of the noisiest aircraft types in (Western) Europe.
However, overall traffic volume is set to increase strongly in all scenarios except the extended (E). As one may expect that the capacity at current major airports remains saturated, a significant part of the expansion will take place at currently less heavily traffic airports. I.e. aviation noise will become more widespread, risking to affect more people in larger areas. Technical measures seem to have an important potential to reduce noise at the aircraft by as much as 6 dB(A). If all these improvements would be applied to the whole aircraft fleet at the current traffic volume, i.e. without any increase or change in take-off and landings as to be expected, these technical measure could help to reduce the share of people highly annoyed by aircraft noise by 25%, according to a sample calculation for the Dutch population (cf. Annex X). Hence, to achieve the target of halfing the perceived noise level stringent measures to manage and eventually contain the air traffic expansion, along with incentives for a quick implementation of technical improvements.

XVII.16. Land take and fragmentation

White Paper measures and scenario calculations include TEN projects, i.e. the expansion of the long-distance transport infrastructure. As the exact design is for many projects not yet defined, we cannot give complete data on their land take and their additional fragmentation. For those projects that could be quantified, the impact assessment (EC 2003) has screened for potential conflicts with Natura2000 sites, i.e. designated nature protection areas. These areas can be considered as particularly precious and/or sensitive areas. They constitute a minimum of what is seen necessary for the protection endangered species, habitats and biodiversity of European importance. There are many more nature areas of national and regional importance, that are not covered in this first screening. Therefore, when Natura2000 sites are affected, this can be considered as an indication of potentially severe disruption or threat.

For about half of the considered 18 TEN projects at least Natura2000 sites are affected, for another half more than two-thirds of data are missing such that no conclusion can be drawn. Most of the potentially conflicting projects concern railway upgrading/extension, where due to its nature, avoidance is particularly difficult. Inland waterway projects seem to be particularly conflicting with nature protection or conservation and account for the biggest part of the affected length (see table below).

Table 44: Screening analysis of potential conflict of selected TEN-T projects with Natura2000

Project number	(A) Total length [km]	(B) for which data available [km]	(C) Length within Natura 2000 sites	(C)/(B) Percentage of intersection [%]	1-(B)/(C): Percentage of area without data
02 Removing bottlenecks on the Rhine-Main-Danube link	136	129	84	65%	5%
04 Mixed railway line Lyon-Trieste/Koper-Ljubljana-Budapest	1320	791	43	5,4%	40%
05 Mixed railway line Berlin-Verona-Napoli/Milan-Bologna	1273	1066	30	2,8%	16%
06 Mixed railway line Greek	601	190	9	5,0%	68%
07 High Speed Railway lines,South – West	1479	1471	139	9,4%	1%
09 Mixed railway line Lyon/Genova –Basel – Duisburg - Rotterdam/Antwerp	1352	589	20	3,4%	56%
10 Mixed railway line Paris – Strasbourg – Stuttgart – Wien – Bratislava	558	463	36	7,9%	17%
12 Multimodal links Ireland – United Kingdom – Continental Europe (Railway)	1299	1272	24	1,9%	2%
12 Multimodal links Ireland – United Kingdom – Continental Europe (Road)	615	614	9	1,5%	0%
14 Fehmarn Belt fixed road and rail link (Railway)	703	304	0	0,0%	57%
14 Fehmarn Belt fixed road and rail link (Road)	156	109	0	0,0%	30%
15 Nordic Triangle (Railway)	243	243	0	0,1%	0%
15 Nordic Triangle (Road)	1811	457	2	0,4%	75%
16 Multimodal link Portugal-Spain-Central Europe	213	213	6	2,8%	0%
18 Motorway Gdansk –Katowice –Brno/Zilina – Wien	970	622	11	1,8%	36%
04 Seine-Scheldt river link	322	164	3	2,0%	49%

Source: EC 2003: Commission of the European Communities: Extended impact assessment of the proposal amending the amended proposal for a decision amending Decision No 1692/96/EC on the trans-European transport network. Commission Staff working paper. SEC(2003)1060.

The length of newly built infrastructure or its related land take are a poor measure for the related impact. Much more important is the fragmentation resulting from the introduction of new line segments separating habitats[17]. The relatively few large unfragmented natural areas in Europe can be considered a scarce resource; they are – by definition – relatively remote areas. Therefore infrastructure expansion faces an

[17] These effects can be described by the mesh size, also taken up in EEA's list of TERM indicators, but it would need quantitative data.

inherent dilemma: When they want to connect remote areas they are bound to destroy them. Both, relative increase in (desired) cohesion and accessibility and impact in (undesired) fragmentation is highest in relatively remote areas. Many of the planned TEN corridors in peripheral countries like Portugal, Spain, Ireland, Greece, Hungary and Slovakia but also France and Germany will increase fragmentation[18].

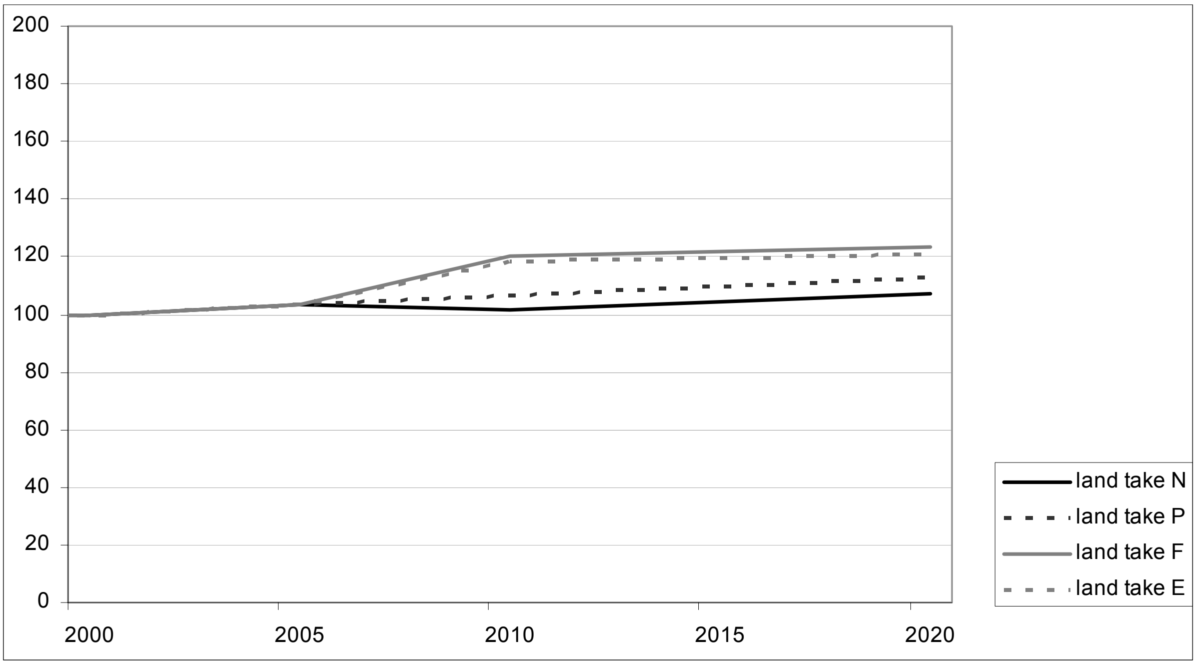
Fragmentation is moreover determined also by the intensity of the infrastructure use. In particular road transport is expected to increase strongly and the traffic pattern to become spatially more spread out. Therefore the use intensity on the whole network is expected to increase, and hence fragmentation effects. Their impact will be the worse in regions/countries, the lower the prior use intensity has been or the more confined traffic has been before.

The table and graph below give a qualitative assessment of the impact of the White Paper on land take and fragmentation.

Table 45: Impact on land take and fragmentation, relative to 2000 (=100)

Indicator			**2010 to 2000**				**2020 to 2000**			
EU15	**Mode**	**unit**	**N**	**P**	**F**	**E**	**N**	**P**	**F**	**E**
Land take	Road	km²	100	105	120	118	105	110	120	118
Fragmentation	Road	km²	100	108	130	130	108	115	130	130
NMS10	**Mode**	**unit**	**N**	**P**	**F**	**E**	**N**	**P**	**F**	**E**
Land take	Road	km²	110	115	120	120	120	130	140	136
Fragmentation	Road	km²	115	123	130	130	130	145	160	154

Figure 33: Land take and fragmentation, EU25, 2000-2020, 2000 = 100



Source: Qualitative assessment by DLR

18 EU 2004.

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