THE FUTURE OF TRANSPORT

Focus Groups' Report

20.02.2009

Executive Summary

In 2001, the Commission issued a White Paper setting an agenda for the European transport policy throughout 2010. Approaching the end of the ten-year period, it is time to prepare the ground for later policy developments, which can only be determined by looking further ahead and defining a long-term vision for the future of transport and mobility.

Meaningfully discussing the future of transport, especially 40 years ahead, requires not only significant expert knowledge, but a lot of courage and some imagination. Despite the inevitable divergences of opinions, the participants of the Focus Groups have summarized their findings in this report which aims to provide an input into the European Commission's Communication on the Future of Transport.

This document identifies seven factors – that influence transport demand or supply – as the most basic drivers of future transport activity: ageing, migration and internal mobility, urbanisation, regional integration, globalisation, climate change, and technology, in particular energy and information technologies.

Assuming that current trends in these generating drivers continue, a scenario can be constructed where in 2050 the European Union will be part of a more globalised world economy, and will build even stronger relationships with neighbouring countries. It will be populated by an ageing and multicultural society which will live in dense urban areas under a changed climate. People's lives will have been transformed by breakthroughs in energy, transport and communication technologies.

The transport sector in this scenario will have to satisfy a greater demand for mobility. At the same time it will have to find solutions to address its negative externalities, which affect the environment (pollution, CO_2 emissions, and noise), the economy (congestion) and the society (health, safety and security).

Those challenges require profound innovations in the world of transport and convey the feeling that we are living in a period of transition and transformation. Policy initiative is needed to shape a sustainable future for transport, but this requires an understanding of the complex interaction between the political, economic, social, environmental and technical aspects of the transport activity.

A combination of policies aiming at technological development, behavioural change and infrastructure provision can assist European citizens in reaching the desirable future of an inclusive society connected by an integrated and sustainable transport system.

1. INTRODUCTION

Purpose of the report

1. The European Commission is preparing a Communication aiming to provide some insights into long-term future developments of the transport sector, as influenced by different internal and external drivers. The purpose is to identify some of the main challenges that these developments will pose to society and suggest possible policy responses to address them.

2. As part of the preparation work for the Communication, three 'focus groups' have been established to gather expert views on the determinants of transport. The three groups have dealt, respectively, with aspects pertaining to: i) the economy and society; ii) the environment and technology and iii) infrastructure and logistics. This report summarises the discussions and conclusions of the working groups.

Structure of the report

3. Transport is generally considered as a sector with 'derived' demand, dependent on a wide variety of social and economic factors. Consumption and behaviour patterns (lifestyle, transport choice), land planning, the organisation of production, the availability of infrastructure, market integration and international specialisation are only some of the aspects that influence transport demand and supply. A brief description of transport data and past evolution is given in Chapter 2.

4. Most of the factors influencing transport are interrelated with each other; and, conversely, transport developments have impacted these aspects as well. The discussion in the focus groups has strived to identify a small set of 'basic' drivers that have a lower degree of interdependence, seem to shape transport patters more than the other way around, and whose long-term trends are relatively robust and easily detectable. The likely evolution of these basic drivers in the next 20 to 40 years is discussed in Chapter 3.

5. Chapter 4 presents a hypothetic future scenario based on the extrapolation of trends in the basic drivers.

6. The implications of this scenario are discussed in Chapter 5 with respect to key segments of the EU transport system, namely the urban context, the medium and long-range transport of goods and the regional and long distance passengers' travel.

7. The scenario is constructed only for the purpose of identifying the main challenges in the field of transport, for society as a whole and more narrowly for policy-makers. Some risk factors that could significantly alter the scenario are considered in Chapter 6.

8. Broad policy measures that could help reducing the emergence of future problems and place transport activity on a more sustainable path are discussed in Chapter 7.

2. TRANSPORT FACTS AND FIGURES

9. This chapter gives a brief overview of recent trends in transport in the EU. It concentrates on economic, social and environmental aspects.

2.1. Economic aspects

10. The provision of transport services accounts for about 4.2% of total employment and about **4.3% of total value added in the EU**[1]. These figures do not include own account transport. The construction and maintenance of transport infrastructure and of transport means (i.e. road vehicles, ships, trains) is not included either.

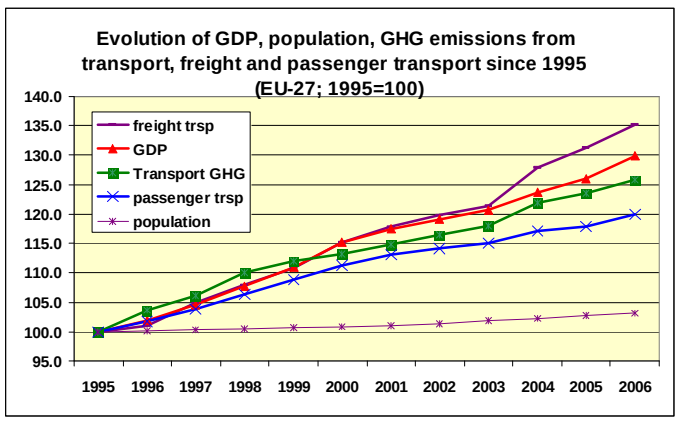
[1] Source: Eurostat.

11. In 2005, around 8.8 million people were employed in the transport sector in the EU. This total only refers to employment in enterprises whose main activity is the provision of transport services. Own account transport activities are not included. **Road transport accounts for slightly more than 50% of all persons employed in the transport sector**. Around two thirds of the people working in road transport enterprises are active in moving freight around, one third in moving passengers. While overall employment numbers in the transport sector have been fairly stable in recent years, some shift between the modes can be observed: rail employs fewer people today than it did in previous years and decades, whereas employment tends to increase above all in road transport.

12. Freight transport is the backbone of the 'real' economy. It binds together various economic sectors and different production stages within the same sector. Moreover, it provides an essential link between production, distribution and consumption. **Estimates put the share of the logistics industry in Europe at close to 14% of GDP**[2]. Efficient logistics is a key ingredient in the competitiveness of an economy. Depending on the industry and the logistics intensity and value of a given product, the share of logistics costs in total production costs may not be trivial. Logistics costs are mainly influenced by technological and organisational developments as well as by the evolution of labour costs and energy prices.

13. Over the past decades, **transport activities in the EU have increased at a sustained pace**. From 1995 to 2006, intra-EU freight transport, measured in tonne-kilometres, has increased by 2.8% per year on average while the average annual growth of intra-EU passenger transport, measured in passenger-kilometres, was 1.7%. This compares with an average GDP growth over the same period of 2.4%[3].

Graph 1. Evolution of transport demand, GHG emissions from transport, GDP and population between 1995 and 2006



14. Intra-EU **freight transport** has thus followed closely developments in GDP, but has also proven sensitive to structural changes in market integration, namely the enlargement of the EU in 2004. The growth of intra-EU road freight transport has

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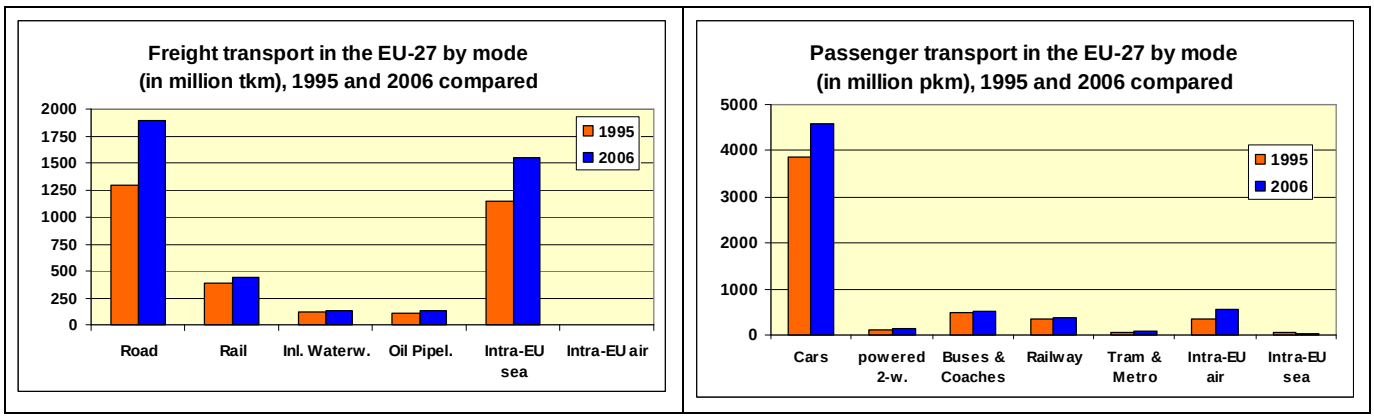
[2] Freight Transport Logistics Action Plan. COM(2007)607.

[3] Unless stated otherwise, the source of transport data is DG TREN (2008), EU energy and transport in figures. Statistical pocketbook 2007/2008.

been more dynamic (+ 3.5% on average per year since 1995) than the evolution of overall intra-EU freight transport. At 1.1%, rail freight showed the lowest annual growth rate of all modes. In recent years, rail has however started to catch up again, mostly in the already open markets. According to latest estimates by Eurostat, around one third of intra-EU freight transport and some three quarters of extra-EU freight transport are by sea.

15. Intra-EU **passenger transport** has grown more than the population – which means a greater mobility (more kilometres travelled) per person – but less than GDP. Although road is still by far the most important mode (it accounts for more than 83% of total intra-EU passenger transport), **air transport growth** has been the most dynamic over the past decade.

Graph 2. Intra-EU freight and passenger transport by mode in 1995 and in 2006



16. Transport is closely interrelated with the rest of the economy. It is 'consumed' by other sectors of the economy: around 30% of the total output of the transport sector is bought by the manufacturing sector; 18% by retail and wholesale trade[4]. By making possible trade, **transport allows competition and, through it, it fosters competitiveness and innovation, and facilitates economic growth**. The EU transport sector is a dynamic sector from an economic point of view. Its labour productivity is bigger than the average for the rest of the economy and compares well with that of the USA, being greater for inland and water transport and lower only for air transport[5].

17. **Transport demand is closely linked to economic growth**. In times of economic slowdown, there tends to be a sudden fall in transport demand, which however is bound to recover more quickly than the rest of the economy. Reactions during previous recessions clearly confirm this resilience of transport demand. In times of economic growth, freight transport usually grows faster than overall GDP. This can in part be explained with the faster growth in international trade.

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4 Source: Eurostat input-output tables.

5 Source: D.Koszerek, K.Havik and others: An overview of the EU KLEMS Growth and Productivity Accounts. DG ECFIN, European Economy, No.290 – October 2007. "EU KLEMS" stands for EU level analysis of capital (K), labour (L), energy (E), material (M) and service (S) inputs.

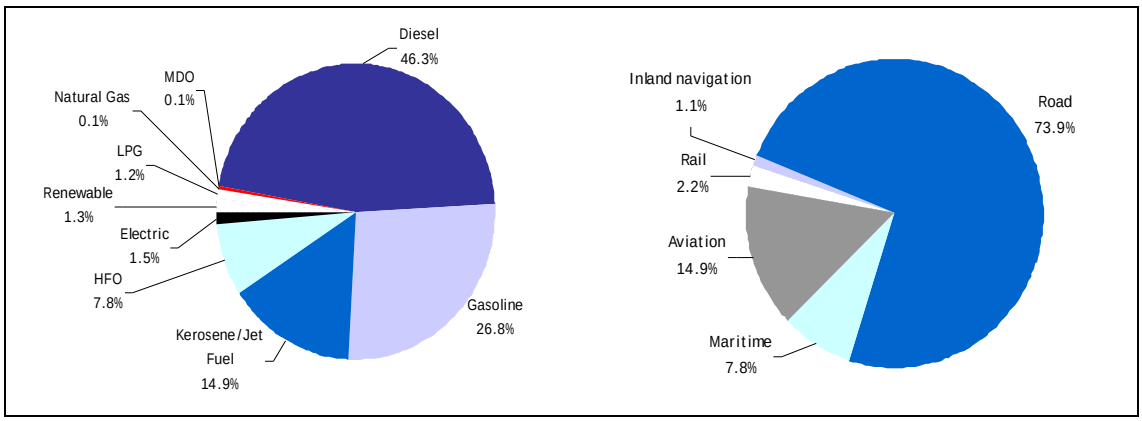
18. **The EU has one of the densest and most developed transport networks** in the world. There are more than 60,000 km of motorways in a total road network of about 5 million km. The total length of railway lines is around 215,000 km, on 5,500 km of which high-speed trains can run faster than 250 km/h (UIC definition of high speed). Inland waterways are navigable over more than 40,000 km.

19. The **Trans-European Transport Network (TEN-T)** covers the most important stretches of the European transport network. By 2020, it will include 95,700 km of roads and 106,000 km of railways, 32,000 km of which will be suitable for speeds of at least 200 km/h (EU definition of high speed). The trans-European inland waterway system will be 13,000 km long. Moreover, 404 major sea ports and 411 international airports are also part of the TEN-T network. Most of the infrastructure is already present, but some missing links still have to be built. About 20% of the TEN-T infrastructure needs to be upgraded by 2020.

20. The cost of road **congestion** is estimated to amount to an equivalent of around 1% of EU GDP per year[6]. This would correspond to 123 billion euros in 2007, about the same size as the total EU budget. Road congestion is a predominantly urban phenomenon.

21. According to calculations undertaken within the EX-TREMIS project, the transport sector in the EU as a whole consumed about 410.6 Mtoe in 2006[7]. Graph 3 below provides an overview of total **energy demand** by source and mode of transport in the EU, covering domestic, intra-EU and intercontinental traffic. Road transport is by far the largest energy consumer; it accounts for 74% of the total. Aviation is the second largest consumer with a share of 15%, followed by maritime transport (7.8%); rail transport accounts only for 2.2% (68% of which is used for electric traction), and finally inland navigation consumes only 1.1%.

Graph 3. Share of transport energy demand by source and mode in 2006 (%)



Source: TRT based on Eurostat and EX-TREMIS data, HFO: heavy fuel oil, MDO: marine diesel oil

6 Chris Nash, with contributions from partners: UNITE (UNIfication of accounts and marginal costs for Transport Efficiency) Final Report for publication, Funded by 5th Framework RTD Programme.

7 The data on energy usage in the transport sector have been obtained by combining Eurostat statistics of energy consumption in transport by source (road, rail and inland navigation only) with estimates of aggregated national and international EU consumption of marine bunkers and aviation fuels made in the EX-TREMIS project. (www.ex-tremis.eu).

22. Since 1990, road transport activity has increased by 61% while its energy consumption only rose by 29%. Consequently, burned fuel per single traffic unit decreased from 0.145 kilograms of oil equivalent (kgoe) in 1990 to 0.116 kgoe[8]. This means that **road transport has improved its energy efficiency by 20%** – mainly as a result of technological developments in vehicles used in passenger transport. Only minor improvements have been observed in road *freight* transport. Some progress has been made in aviation, partially thanks to both fleet renewal and higher occupancy factors. The entrance of new carriers played a significant role in this development. **Maritime transport is still the most energy-efficient transport mode per single traffic unit performed**. It, too, has improved its energy efficiency during the past two decades. The relatively high energy efficiency of rail transport can be explained by principal advantages of the rail-wheel system, by the predominance of electric traction and, as in the case of navigation, by high loading capacities.

Table 1. Transport activity, energy use and unitary consumption by mode in the EU, 1990-2006

Mode of transport	1990	2005	2006	Change 1990-2006
Total demand in equivalent tkm (1 tkm = 10 pkm, billion)				
Rail	487	459	482	-1%
Inland navigation	114	138	138	22%
Road	1,619	2,503	2,608	61%
Aviation	28	56	58	110%
Maritime	5,309	8,638	8,850	67%
Energy use in 1,000toe				
Rail	9,573	9,435	9,199	-4%
Inland navigation	5,654	4,368	4,683	-17%
Road	234,608	297,745	303,317	29%
Aviation	29,138	49,869	51,856	78%
Maritime	20,478	32,188	32,220	57%
Energy consumption in 1,000 toe per unit of traffic				
Rail	0.020	0.021	0.019	-3%
Inland navigation	0.05	0.032	0.034	-32%
Road	0.145	0.119	0.116	-20%
Aviation	1.058	0.899	0.899	-15%
Maritime	0.004	0.004	0.004	-6%

Source: TRT based on Eurostat, INFRAS-IWW and EX-TREMIS data

23. **The enlargement of the EU** has contributed to expanding transport infrastructures and activities. The EU now measures more than 3,000 km from north to south and from east to west. Market integration at a continental scale increases demand for long-distance transport.

24. The EU is the world's biggest trading power. In 2007, it had a share of 17.4% of world exports and of 19.0% of world imports by value. The USA imported slightly

[8] To compute energy intensity (consumption per unit of traffic performed) of each mode of transport, transport activity data collected in pkm and tkm from Eurostat have been transformed in one single traffic unit using the equivalence 1 tkm = 10 pkm.

more (19.1%) while the number two in world exports, China, was still some way behind the EU with a share of 12.2%[9].

25. In 2007, the EU 27 imported goods worth 1,433 billion euros; 23% of this sum has been spent for the importation of energy products. **In terms of weight, energy products accounted for no less than 61.1% of total imports** from countries outside the EU in 2007. Petroleum and petroleum products alone accounted for 37.4% of the total weight of imported goods (61.2% of the weight of all imported energy products). On the export side, energy products accounted for 28.5% of the total weight of all exported goods. In terms of value, the share of energy products in total EU exports in 2007 was just 5.0%[10].

26. **Globalisation** has spurred **increasing trade flows** in recent years and is expected to continue to do so in the future. In terms of value, world merchandise trade grew on average by 5.5% per year between 2000 and 2007. While the average annual growth rate in the EU-27 was 4.0% for exports and 3.5% for imports, the growth was much stronger in other parts of the world: Chinese exports, for example, grew on average by 22.5% per year while the average yearly growth rate of its imports was 18.0%.[11] As most international trade is carried in ships, maritime transport – above all in containers – has strongly increased. Between 1997 and 2008, container trades grew on average by 9.8% per year.[12]

27. As far as the EU is concerned, the **fastest growing trade routes are those between the EU and the emerging giants**. From 2000 to 2007, trade between the EU and Russia increased by 325% in value, between the EU and China it grew by 250% and between the EU and Turkey, trade in 2007 was 111% above the level in 2000.[13]

28. The rise of the emerging economies has had a huge impact not only on transport of goods between these countries and the EU but also on the evolution of passenger traffic. The number of **air passengers between China and the EU**, for instance, **more than doubled** between 2003 and 2007. The growth rates between the EU and these countries are expected to remain above average in the foreseeable future.

29. **The growing importance of the emerging economies has a huge impact on their transport infrastructure**. Shanghai has become the world's busiest port by throughput in 2005. Moreover, the number of Chinese airports in the 100 busiest airports of the world has doubled between 2000 and 2007.[14] These countries will (have to) invest heavily in their transport infrastructure to be able to cope with the expected rise not only in traffic between them and the EU, but above all in internal traffic.

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9 Eurostat (2009), External and intra-European trade. Statistical yearbook – Data 1958-2007.

10 Eurostat; COMEXT database.

11 WTO (2008): International Trade Statistics 2008.

12 OPTIMAR – Benchmarking strategic options for European shipping and for the European maritime transport system in the horizon 2008-2018. Study produced by Lloyd's Register Fairplay for DG TREN in 2008.

13 Eurostat (2009), External and intra-European trade. Statistical yearbook – Data 1958-2007.

14 It went up from 4 to 8 (incl. Hong Kong) (for comparison: EU-27: 23 airports among the Top-100 in 2000, 26 in 2007, US: 40 in 2000, 33 in 2007). Source: Air Transport Intelligence.

2.2. Social aspects

30. Households in the EU spend about 13.5% of their income on transport-related goods and services. Roughly half of this is spent on the operation of personal transport equipment (e.g. fuel), the other half on the purchase of personal transport equipment (e.g. a car) and the purchase of transport services (e.g. bus, rail, air tickets). **Transport is the second biggest budget item after house-related expenditures** (housing, electricity, water and gas, 21.4%). Its share has been stable over the past years, as consumers have spent more of their income on communication and leisure services (hotel, restaurants, recreational activities…) but less on clothing and food[15].

31. Studies based on travel and mobility surveys point to a more or less **constant amount of personal time devoted to transport**: the average travel time budget per person is estimated to be around 1.1 hour a day[16]. It has hardly changed over the last 40 years and, besides, appears to be independent from someone's income (yet not necessarily from his age – people older than 64 tend to spend less time travelling than their younger fellows). This suggests a greater relevance of the time constraint versus the resource constraint in determining overall levels of mobility. Whether this trend will hold in an ageing society with more travel-prone retired people remains to be seen.

32. The nevertheless observed substantial **increase in personal mobility** over the last couple of decades can to a substantial part be explained by a **shift to faster transport means** (high-speed trains, aircrafts, higher car ownership resulting in more driving instead of walking or cycling, etc.).

33. It is unclear whether the increase in general mobility is also due to **longer distances which people have to cover to make their basic provisions**. Urban sprawl, the rise of super- and hypermarkets and the loss of the grocery store around the corner may have contributed to such a situation.

34. **Walking and cycling** are important modes of transport, in particular on trips up to 1 km. In the Netherlands, for instance, 80% of all commuter journeys that are shorter than 1 km are done by walking or cycling. The share of walking and cycling drops to around half for distances between 1 and 5km. Overall, one in four commutes was done by bicycle in 2007, roughly the same share as in 2000[17]. The Netherlands being a flat and relatively cycling-friendly country is however not representative of the whole EU.

35. Travel surveys show that the overwhelming **majority of trips (97.5%) are 'short' distance** (not longer than 100 km). The remaining 2.5% of trips account however for more than half (53%) of all pkm[18].

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15 Source: Eurostat.

16 See, for example, Arie Bleijenberg: The driving forces behind transport growth and their implications for policy; Contribution to the international seminar "Managing the fundamental drivers of transport demand", hosted by the European Conference of Ministers of Transport (ECMT), Paris 2002.

17 Source: Statistics Netherlands (www.cbs.nl).

18 Source: Transtools.

Table 2. Trips and pkm by mode and distance

	Billion pkm per year				Billion trips per year			
Mode	<100km	%	>100km	%	<100km	%	>100km	%
Air	0.0	0.0	560.0	100.0	0.0	0.0	0.5	100.0
Bus/Coach	249.0	37.6	412.8	62.4	35.4	95.4	1.7	4.6
Car driver	1443.4	59.4	987.1	40.6	235.8	98.1	4.6	1.9
Car passenger	809.6	53.8	694.8	46.2	134.7	97.9	2.8	2.1
Rail	64.8	22.5	223.9	77.5	5.4	85.2	0.9	14.8
Total	2566.8	47.1	2878.6	52.9	411.3	97.5	10.6	2.5

Source: Transtools.

36. According to some studies[19], **40% of all trips are work-related; the remaining 60% falling into the categories of leisure activities and informal work** (such as household work and child-care). This is more or less reflected in the average time people spend on these activities during the day. Leisure time (and travel) could become more prominent in the future, as time use surveys show a tendency in more prosperous societies for leisure time to approach time devoted to obligatory activities, those being equally divided into formal and informal work.

37. **Age clearly influences travel patterns.** Above a certain age, people travel less than when they were younger. The general increase in life expectancy and improved health provision however mean that older people can nowadays enjoy the pleasures of independent mobility for longer than previous generations. Moreover, old people today generally travel more than the same age group did in previous decades. This is above all due to the greater availability of mobility (e.g. higher car ownership[20]; cheaper air travel) and to the acquired habit of travelling more. The 'baby boomers', for example, which are soon to retire, have experienced the development of mass tourism. They are not expected to lose such habits until old age. Of course, the travel behaviour of the retirees is ultimately also influenced by their disposable income.

38. **The European transport system has become safer** over recent years and decades. The number of fatalities has gone down in all modes of transport compared to the 1970s and 1980s – despite a significant increase in traffic. Data from the UIC suggest that the number of fatalities in railway accidents in the EU-15 has gone down from 318 in 1980 to just 51 in 2005. The number of fatalities in air crashes over EU territory has also gone down from an average of 242 per year in the 1980s to 57 in the 1990s (it has since however gone up again to an average of 75 between 2000 and 2008).

39. Road transport, which still causes the vast majority of all deaths due to transport and traffic, has also seen some improvement in its safety record: The number of road accidents involving personal injury has gone down by about 12% between 1991 and 2007. More importantly, the number of **road fatalities** has in the same time

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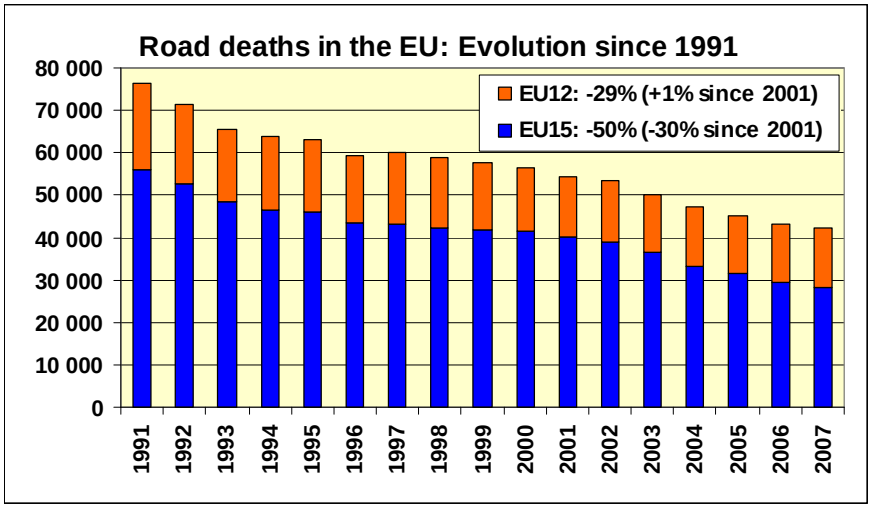
19 See, for example, Schaffer, A. Regularities in Travel Demand: An International Perspective. Journal of Transportation and Statistics 3, no. 3 (2000): 1-31.

20 A Dutch study shows that aged people prefer travelling by car for leisure trips, and public transport is rather seen as substitute for walking and cycling. Source: Schwanen et. Al (2001) Leisure trips of senior citizens: determinants of modal choice cited in EEA (2008) Beyond transport policy - exploring and managing the external drivers of transport demand, Technical report No 12.

decreased by more than 44%. Although the number of fatalities has gone down by more than 21% between 2001 and 2007, there is still a lot to do to achieve the EU target of halving the number of road fatalities by 2010 compared to 2001 levels.

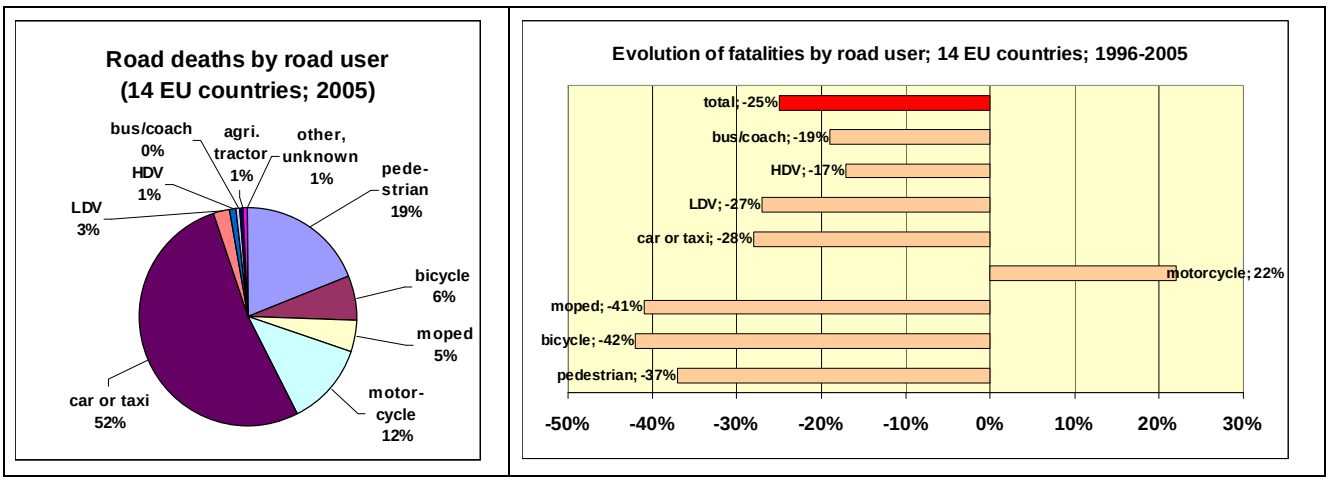
Graph 4. Evolution of road fatalities in the EU between 1991 and 2007



Source: CARE database

40. The improvements in **road safety have not benefited all categories of road users**. According to data from 14 EU countries (EU-15 without DE), the number of deaths of motorcycle riders has increased by 22% between 1996 and 2005 while the number of fatalities of all other road user categories has gone down[21].

Graph 5. Road fatalities by road user; data from 14 EU countries



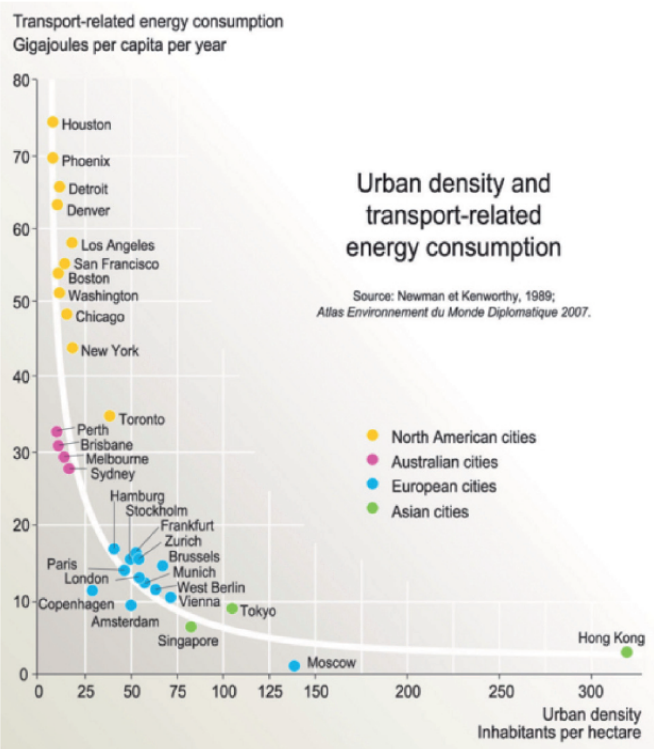
Source: CARE database; ERSO Annual Statistical Report 2007.

41. More and more road motor vehicles are driving on Europe's roads. The stock of passenger cars in the EU-27 countries has gone up by around 40% since 1990 to reach a total of about 230 million in 2006. **Motorisation levels have gone up** by 35% from 345 cars per 1,000 inhabitants in 1990 to 466 cars per 1,000 inhabitants in 2006. Car ownership levels increase fastest in the new Member States which still have some catching up to do to reach the levels in the old Member States.

42. **Urbanisation has increased over the past decades** (51.2% in 1950, 72.2% in 2005 in Europe[22]) and has modified transport needs. Local and short distance trips, collective transport and commuting are issues specific to urban transport. By the same token, the negative externalities of transport – congestion, air pollution, noise – are far higher in urban areas. An urban environment shortens distances and allows for economies of agglomeration which, from a certain size and under certain conditions, may however become diseconomies (congestion, high land prices and rents, insecurity).

43. **Urban sprawl has accompanied the growth of urban areas** across Europe over the past 50 years. Historical trends, since the mid-1950s, show that European cities have expanded on average by 78 %, whereas the population has grown by only 33%[23]. A major consequence of this trend is that European cities have become much less compact. Transport-related energy consumption however is inversely correlated to the density of a city. Car dependency and car ownership levels tend to be lower in denser cities.

Graph 6. Urban density and transport-related energy consumption



Source: EEA Technical Report No 12/2008, based on Peter Newman & Jeffrey Kenworthy (1999): Sustainability and Cities: Overcoming Automobile Dependence. Island Press, Washington DC

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21 CARE database; ERSO Annual Statistical Report 2007.

22 United Nations, Department of Economic and Social Affairs/Population Division (2008), World Urbanization Prospects: The 2007 Revision.

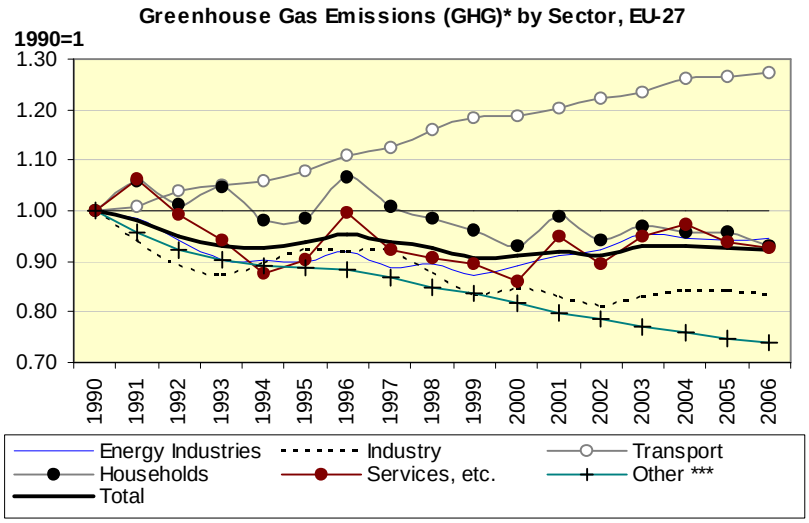
23 EEA (2006), Urban sprawl in Europe - The ignored challenge. EEA Report No 10/2006

2.3. Environmental aspects

44. Under the **Kyoto Protocol**, the EU-15 agreed to reduce its greenhouse gas (GHG) emissions by 8% below base year (mostly 1990) levels in the commitment period 2008 to 2012. In 2006, EU-15 GHG emissions were 2.7% lower than base year levels while EU-27 GHG emissions were 10.8% below base year levels[24]. In the fight against climate change, the EU set itself the target of reducing GHG emissions by 20% in 2020 compared to 1990 levels. This target could be raised to 30% in case an international agreement is reached. Moreover, the EU has decided to increase the share of renewable sources in its energy mix to 20% by 2020, and it aims at improving its energy efficiency by 20% by the same date.

45. According to data from the EEA, transport accounted for close to a quarter (23.8%) of total GHG **emissions** and slightly more than a quarter (27.9%) of total CO_2 emissions in the EU27 in 2006. Compared to 1990 levels, in no other sector has the growth rate of GHG emissions been as high as in transport. This can be explained with the relatively strong growth in transport activity over recent years and its failure to offset this growth by improving its energy efficiency / by reducing its carbon intensity. As the transport sector relies on fossil fuels for almost 97% of its needs, in this sector the fight against climate change can go hand in hand with efforts to improve the security of supply of its energy needs.

Graph 7. Greenhouse Gas Emissions by Sector, EU-27, 1990-2006



Source: EEA.

46. **Several measures have already been adopted in the EU to curb emissions from transport**. To give examples, the fuel efficiency of passenger cars is to be increased for the average new car fleet to emit no more than 120 g of CO_2 per km by 2015[25]. From 2020 the agreed Regulation introduces a target, for the new car fleet, of average emissions of 95 g CO_2/km. The European Commission is currently drafting a

[24] European Commission, DG Environment.

[25] Vehicle manufacturers will be required to reduce the CO_2 emissions through mainly improvements in vehicle motor technology to 130g/km by 2015, while the additional 10g/km reduction is to be achieved by other technological improvements and by the increased use of renewable energy sources.

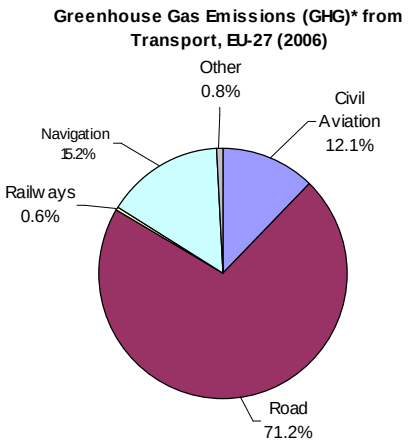
legislative proposal that limits the CO_2 emissions from vans. Regarding aviation, emissions from all flights arriving to and departing from Community aerodromes will be covered by the EU Emission Trading Scheme (EU ETS) from 2012 onwards. Electricity used in rail transportation has been included in the EU ETS since 2005. Moreover, as part of the renewables target, the share of energy from renewable sources in all forms of transport in 2020 is to be increased to at least 10% of final consumption of energy in transport.

47. Electricity falls into this category if it is generated from renewable sources. The use of electricity to power transport means is however not yet widely spread. **Rail is currently the only mode of transport where electric traction plays an important role**: according to figures provided by Deutsche Bahn, around 80% of total rail performance (passenger and freight transport put together) is powered by electricity.

48. It is estimated that some 40% of total CO_2 emissions and 70% of emissions of other pollutants from road transport are due to **urban traffic**[26].

49. Road is by far the main emitter of GHG from transport. In 2006, it accounted for 71% of all **GHG emissions from transport**. Maritime and air transport follow with shares of 15 and 12% respectively. The emissions of rail transport do not include the emissions of the power stations while they produce the electricity used in rail transport. If these emissions were taken into account, the share of rail would increase to about 1.6%[27].

Graph 8. **Greenhouse gas emissions from transport by mode of transport**[28]



Source: EEA.

50. The **CO_2 intensity of the various modes of transport** depends to a large extent on the loading factor / occupancy rate, the weight and the speed of the vehicle, the fuel used and the distance covered.

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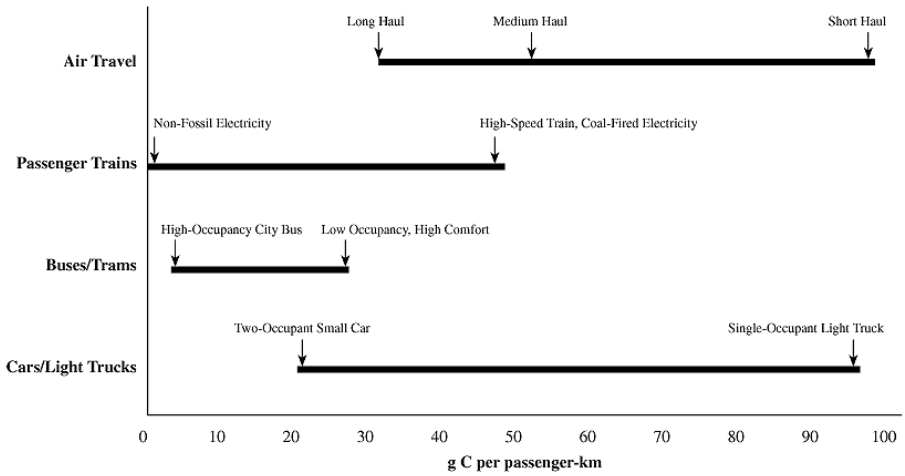
[26] European Commission, Green Paper: Towards a new culture for urban mobility (COM(2007)551 final).

[27] Source: UIC energy/CO2 database.

[28] Shares of civil aviation and navigation include international bunkers.

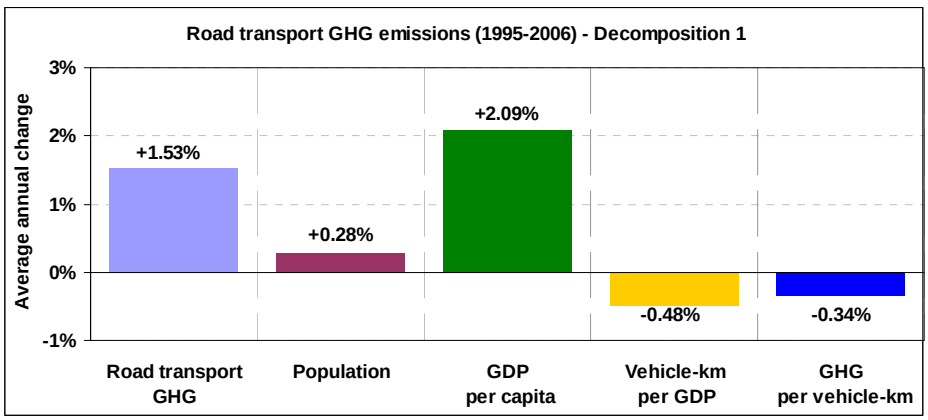
Graph 9. Modal comparison of CO_2 intensity in passenger transport



Source: (TEST, 1991; Whitelegg, 1993; Faiz et al., 1996; Centre for Energy Conservation and Environmental Technology, 1997a; OECD, 1997a) in IPCC (1999) - J.E.Penner, D.H.Lister, D.J.Griggs, D.J.Dokken, M.McFarland (Eds.) Aviation and the Global Atmosphere.

51. While on average road vehicles emit less GHG per km travelled than 10 years ago, i.e. the energy efficiency of road vehicles has slightly improved, **total emissions have increased due to the rise in activity** that could not be offset by efficiency improvements.

Graph 10. Decomposition of GHG emissions from road transport (1995-2006) in EU-27



Source: EC calculations

52. A global comparison of the **fuel efficiency** of both cars on the road and of new cars, undertaken by Dr. Lee Schipper[29], show that while there have been some improvements in European countries and Japan in recent years, the fuel efficiency of cars in the US has hardly improved since 1990. While cars on European roads on average consume 8.1 l of fuel per 100 km, cars in Japan require 10.2 l /100 km and the average car in the US needs 11.4 l/100 km (40% more than cars in Europe).

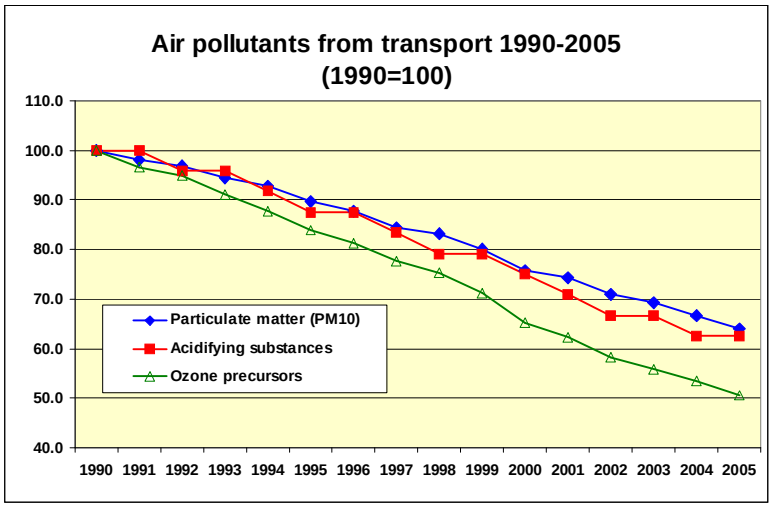
[29] Lee Schipper: Automobile Fuel; Economy and CO_2 Emissions in Industrialized Countries: Troubling Trends through 2005/6. EMBARQ, the World Resources Institute Center for Sustainable Transport; http://pdf.wri.org/automobile-fuel-economy-co2-industrialized-countries.pdf

53. Traffic-related air pollution, noise, accidents and social impacts combine to generate a wide range of **negative health consequences**, including increased mortality, cardio-respiratory and stress-related diseases, cancer and physical injury. These affect not only transport users, but the population at large, with particular impact on the vulnerable groups such as children and the elderly, cyclists and pedestrians.

54. In terms of air quality, transport – in particular road transport – is generally becoming less polluting due to increasingly **strict air pollutant emission standards**. The implementation of new technologies is being driven by stepwise tightening of on- and off-road vehicle emission standards. The EURO emission standards have been a powerful tool for reducing transport emissions.

55. With increasingly tight emission standards being applied to land-based sources, the **share of maritime transport in total pollutant emissions** is bound to increase further in the coming years. The contribution of shipping to acidifying pollutant emissions has been increasing both in relative and absolute terms. Measures agreed at the IMO such as the review of MARPOL Annex VI on SO_x and NO_x should however help reducing some harmful emissions from shipping in the future.

Graph 11. Evolution of air pollutants from transport (1990=100)

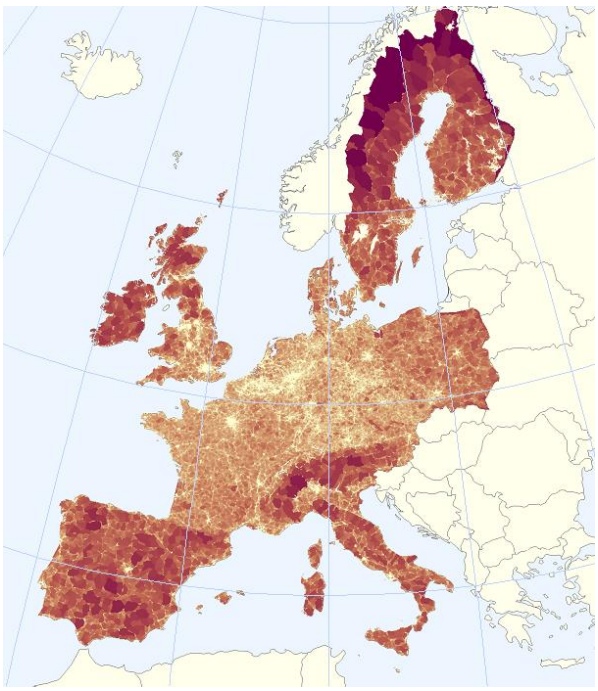


56. Despite improvements in **air quality**, people in European cities continue to be exposed to significant health threats due to air pollution. Only 11 EU Member States expect to remain within their emission limits for all four air pollutants set by the EU National Emission Ceilings Directive (SO_2, NO_x, VOCs, NH_3). The nitrogen oxides ceiling remains the most difficult to comply with.

57. Transport (road, rail and air traffic) is the most important **source of community noise in the EU**. Approximately 30% of the EU-15 population or close to 120 million people are exposed to levels of road traffic noise of more than 55 dB(A). In general, many people are annoyed and disturbed in their sleep at these levels. Exposure to high noise levels has decreased substantially in some countries since 1980 due to technological (e.g. reduction of emissions, change of road surfaces) and spatial measures such as noise barriers and spatial separation of transport and

residential functions. Nevertheless, noise levels are expected to rise again in the next decades due to the growth in traffic volumes, unless additional measures are taken[30].

Graph 12. Landscape fragmentation in 2006[31]



Source: European Environment Agency, based on Teleatlas 2006
(areas of high fragmentation are bright; areas of high connectivity are dark)

58. It is estimated that built-up areas account for some 1% of the world land area, with actual physical structures representing about 1/5 of this figure. In urban environments, the space used by transport infrastructures is similar to that occupied by buildings[32]. Estimations by the EEA of 2004 indicate that roads account for 93% of the total area of **land used for transport** in the EU15, and 85% in the EU10. Rail takes only 4% in the EU15 and 10% in the EU10[33].

59. Transport infrastructure can give rise to a wide range of impacts such as habitat loss or fragmentation from transport location and development and species disturbance from the operation of transport or from the impacts of development 'encouraged' by the transport networks. **Landscape fragmentation** by infrastructure is closely related to population density and is greatest in western and central Europe where the transport network is densest.

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30 Transport-related Health Effects with a Particular Focus on Children. Towards an Integrated Assessment of their Costs and Benefits. State of the Art Knowledge, Methodological Aspects and Policy Directions. Contribution to the UNECE-WHO Transport, Health and Environment Pan-European Programme (THE PEP); http://www.euro.who.int/Document/trt/PEPNoise.pdf, p.19.

31 The map shows the Effective Meshsize (MEFF), a geo-statistical measure, which converts the probability that randomly selected points in an area are connected into the size of an unfragmented patch, measured in km2. The smaller the meshsize, the higher the landscape fragmentation and vice versa. MEFF actually measures landscape 'connectivity' that is the inverse of fragmentation.

32 Cf. Arnulf Grübler, Technology and Global Change, Cambridge University Press, 2003. pp. 186-188.

33 EEA (2002), TERM Fact Sheet 2002 08 EU+AC – Land take by transport infrastructure.

3. GENERATING DRIVERS SHAPING TRANSPORT ACTIVITIES

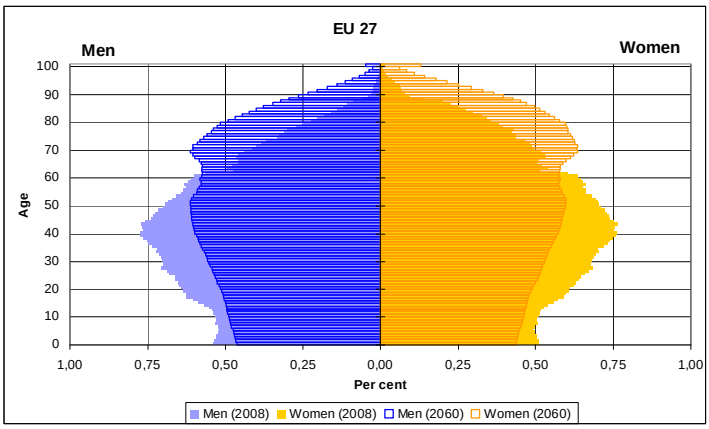
60. This section of the document identifies seven factors – among the various **drivers of transport activity –** as the most basic forces to shape future scenarios and to have an impact on the transport system: ageing, migration, urbanisation, globalisation, regional integration, climate change and technology.

3.1. Ageing

61. The **European population is expected to remain fairly stable in number** at around 500 million over the forthcoming 50 years, but will become much older. The median age will rise from 40.4 years in 2008 to 47.9 years in 2060[34].

62. The **pyramid of age** in Europe in 2060 gives a good indication of the process of ageing in Europe. Only unrealistically large increases in net immigration or birth rates could curb this trend. In 2060, the old aged dependency rate (ratio between the number of people aged 65 and over and the number of people aged 15-64) will be more than 0.50, although the definition of dependency may change, moving to 70 years from 6535. The number of people aged 80 years or more is expected to almost triple from 21.8 million in 2008 to 61.4 million in 2060[36].

Graph 13. Population Pyramid in EU27 - 2008, 2060



Source: EC(2008), Demography Report 2008, p.5

63. As a result of the ageing of the population, there might be scarcity of labour and skills. The total of employed people is foreseen to peak in 2019 and subsequently fall by 15% by 2060. The lower availability of labour could jeopardise improvements in standards of living. Due to this development, GDP growth is expected to be higher in the period up to 2030 than from there on[37]. **The prospect of lower GDP growth**

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34 Eurostat (2008), Population and social conditions. Statistics in Focus 72/2008.

35 For comparison, the old-age dependency ratio for the EU-27 in 2008 was 0.25 (Source: SEC(2008) 2911).

36 European Commission, Demography Report 2008: Meeting Social Needs in an Ageing Society. SEC(2008) 2911.

37 Based on projections by the European Commission and the Economic Policy Committee; Source: The 2009 Ageing Report: Underlying Assumptions and Projection Methodologies for the EU27 Member States (2007-2060) (European Economy 7/2008).

than in the recent past constitutes a crucial challenge that European society has to meet. To counter this development, the integration of immigrants, innovative work practices and learning measures for older workers would be required, probably accompanied by a flexible withdrawal age from the working life.

64. Through two channels, **the ageing phenomenon will lay claims on public funds**: firstly, through an increase in pension payments, and secondly, through greater requirements for health care, including the care for the very old.

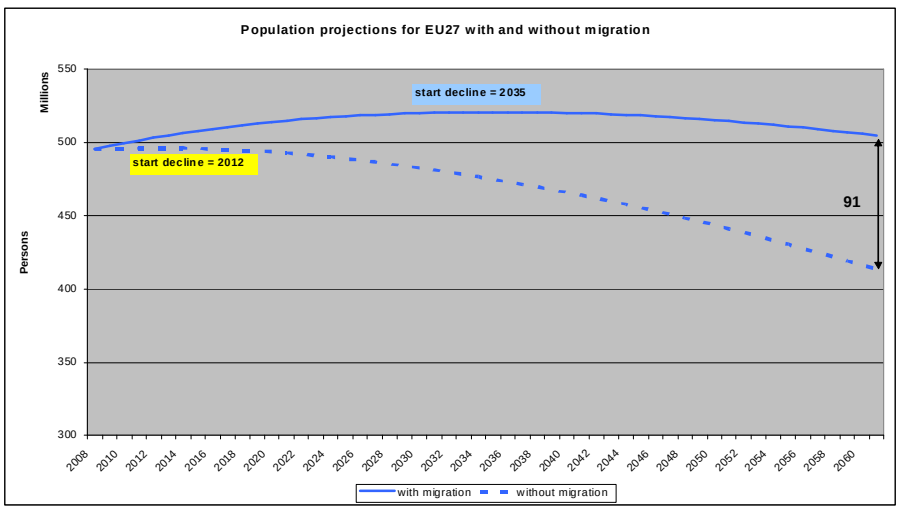
3.2. Migration and internal mobility

65. Migration patterns are less predictable than fertility rates and life expectancy. According to the latest estimates[38], **the cumulative effect of net migration could be to increase the EU's population by 56 million by 2061**. Cyprus, Luxembourg, Spain, Portugal and Italy are expected to receive the largest migration flows in relation to their projected total population.

66. **Without immigration, Europe's population would start shrinking from 2012** onwards. Assuming a certain level of migration would postpone the beginning of decline until 2035.

67. **Mobility within the EU is still relatively low**: only around 2% of working-age citizens from one of the 27 EU Member States currently live and work in another Member State. However there appears to have been a gradual increase in mobility over recent years[39]. It is expected that this trend would continue due to the gradual removal of obstacles to geographical mobility such as legal and administrative barriers, and to the further development of the EU internal labour market.

Graph 14. Population size in EU-27 with and without migration, 2008-2061



Source: EC (2008), Demography Report 2008, p.53

38 SEC(2008) 2911

39 The number of mobile workers within the EU-15 has increased from about 470 000 persons in 2000 to around 610 000 in 2005. Source: Mobility, an instrument for more and better jobs: The European Job Mobility Action Plan (2007-2010), COM (2007) 773

3.3. Urbanisation

68. In Europe, **the proportion of the population residing in urban areas is expected to increase** from 72% in 2007 to 84% in 2050[40]. Towns and cities produce the largest share of value added in both industry and services. Urban quality and efficiency are key variables for economic growth as for compliance with the requirements of sustainable development.

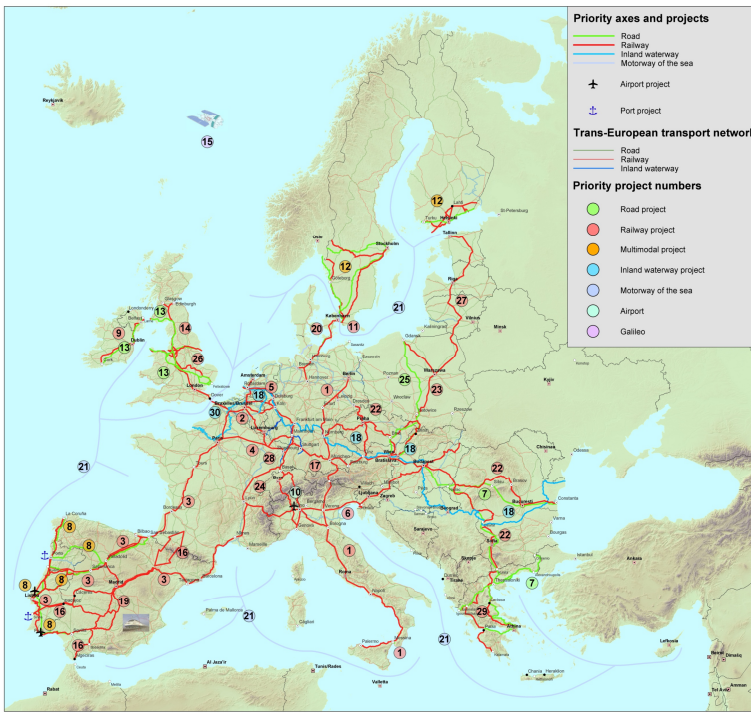
69. Towns and cities are based on the beneficial agglomeration effects that stem from density. Securing accessibility is an ongoing challenge for all major cities. Two broad tendencies are at work in spatial development in major cities in Europe. **There is a tendency to concentration on regional and interregional level**. This will create 'mega city regions' on a higher level.

70. The other tendency is sub-urbanisation which is turning mono-centric urban areas into complex **polycentric urban conurbations**, with several local and regional centres, having complex institutional structures involving many local municipalities. This trend is slowed down by the re-urbanisation of city centres stimulated by active public policy and the increase in the number of small households. Re-urbanisation leads to denser cities as a way to circumvent congestion and revitalize city life. Congestion in these highly urbanized areas will remain a challenge.

3.4. Regional integration

71. The existing and planned **TEN-T network** supports regional integration in the EU.

Graph 15. TEN-T Priority areas and projects

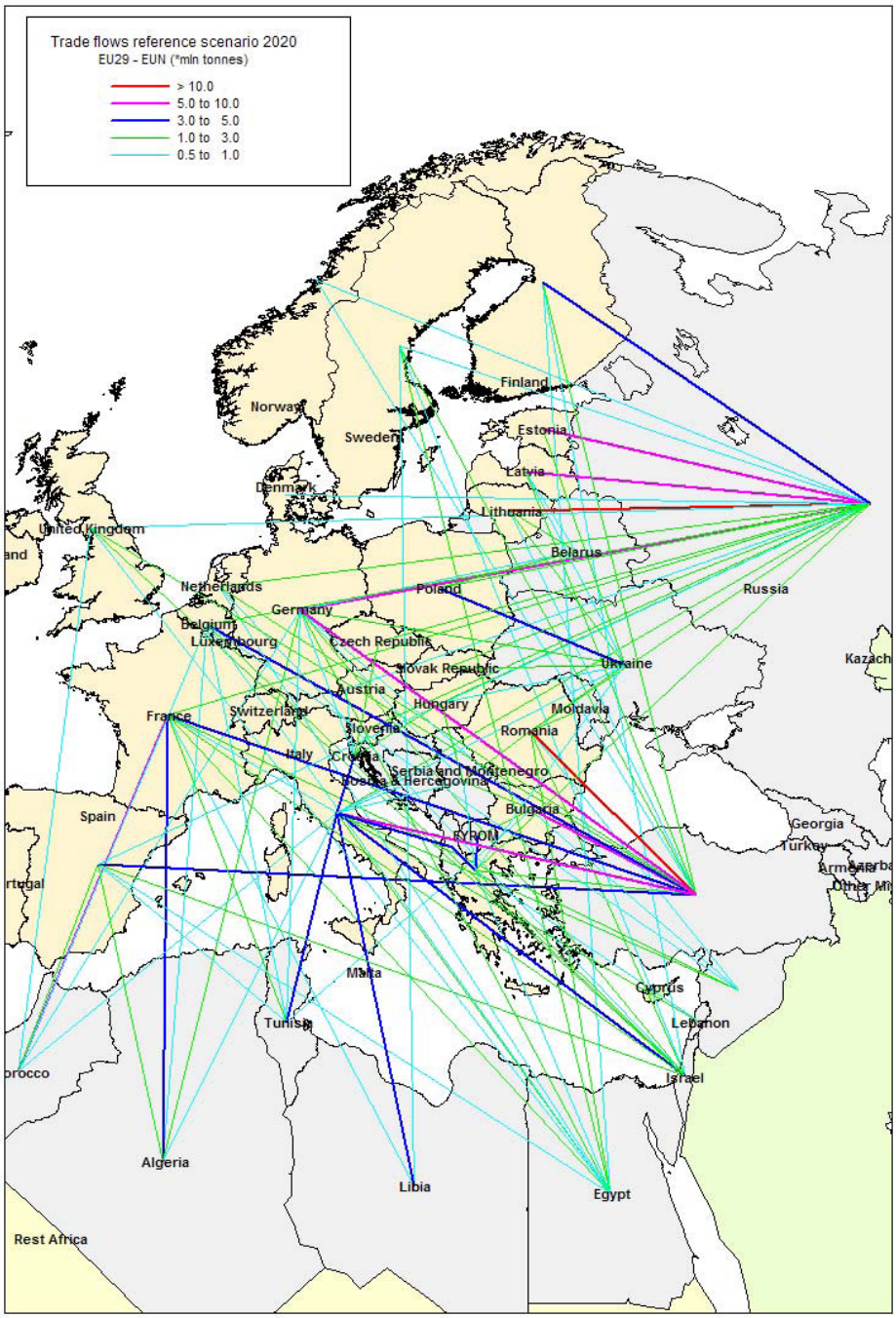


[40] United Nations, Department of Economic and Social Affairs/Population Division (2008), World Urbanization Prospects: The 2007 Revision.

72. European regional integration is likely to increase and produce **stronger links with both Mediterranean and Eastern European countries**. Russia and Turkey could emerge as the two main 'poles' of trade flows in relation with the EU. The value of trade by road between the EU and the Commonwealth of Independent States, Turkey and the Balkan countries is already high, amounting to EUR 175.5 billion in 2007.

73. **North Africa has the potential to develop as an important trade partner to EU**. The population in North Africa today is around 141 million and is expected to grow to 236 million in 2050.

Graph 16. Relationships with neighbouring countries



Source: Scenarios, traffic forecasts and analysis of traffic flows including countries neighbouring the European Union. NEA transport research. Dec 2005.

3.5. Globalisation

74. Globalisation refers to the ongoing trend in the decrease or elimination of restrictions on exchanges of goods, services, capital, ideas and, to a lesser extent, labour across borders. The result is deeper integration of countries and regions into an emerging global system of production and exchange. It has been one of the main characteristics of economic and social developments over the last 50 years. This development has been fostered by cheap transport and development in communication systems. Whereas political and economic crises, and delays in trade negotiations, can temporarily slow down this process, **progress in communication and transport technologies and the economic catching-up of large parts of the world would suggest a continuation of this trend**. Further economic integration and the emergence of new players contribute to increasing trade exchanges.

75. An important feature of globalisation has been the **ever increasing international trade**, firstly among neighbouring regions and countries and traditional trade partners, secondly, and now increasingly, between the western countries and the new emerging economies – the Asian tigers and later the BRIC countries[41]. International trade, induced by lower barriers to trade and transport costs, has overall increased economic growth and economic welfare because it has allowed for a wider and deeper specialisation in production and has given producers and consumers more choice at more favourable prices.

76. Increasing **returns to scale is a critical factor in this kind of international trade**: initially, with the production cost advantage of a large 'home market' a firm can succeed on foreign markets; however, the larger such a foreign market becomes, the more attractive it gets to locate production in or close to that market instead of exporting to it. Failing to do so could ultimately lead to losing the whole market to local producers as they can exploit economies of scale too, but then without transport costs.

77. It is clear that the ongoing globalisation will continue to shape the transport patterns into and out of the EU, namely boosting the volume growth of goods exported from or imported into the EU and enlarging the set of destinations and origins respectively. **Foreign direct investments** of EU firms in non-EU countries and also re-localisation of existing EU manufacturing industry activities towards countries with a better productivity/labour cost ratio tend to lead to additional transport flows, as the new subsidiary firms have a high tendency to trade with the mother firm.

78. Given the current market size of the emerging economies, **it is unlikely that an end to the trend of falling transport costs would stop globalisation**. It would however affect the shape of international trade (probably a regionalisation of international trade) and the place of the EU in the global system.

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[41] Brazil, Russia, India and China.

3.6. Climate change

79. **Between 1970 and 2004, global emissions of greenhouse gases (GHG) have increased by 70%** from 28.7 to 49 gigatonnes of carbon dioxide equivalents ($GtCO_2$-eq). Under current policies, emissions could continue to grow within a range of 9.7 to 36.7 $GtCO_2$-eq (or increase by 25 to 90%) between 2000 and 2030[42].

80. While in 2004 the transport sector produced 6.3 $GtCO_2$ emissions (23% of world energy related CO_2 emissions) globally, the total transport energy use and carbon emissions is projected to be about 80% higher than current levels by 2030[43]. Regarding **the EU, several modelling results point to an increase in transport emissions**[44], although some projections indicate a possible stabilisation at current emission levels by 2010 in EU-15 countries, with the existing measures in place[45].

81. Without new climate policies, the OECD **Baseline scenario predicts that CO_2-eq concentration in the atmosphere will reach 465 ppm by 2030 and 540 ppm by 2050**. This would imply an increase in global mean temperature to 1.9°C (within a range of 1.7 to 2.4°C) in 2050, compared to pre-industrial levels, and an acceleration in the temperature increase to 0.28°C per decade (up from 0.18°C) by 2030.

82. In order **to limit global mean temperature change compared to pre-industrial levels to near 2°C over the long term, atmospheric concentrations of GHG must be stabilised at 450 ppm CO_2-eq**. This would require global GHG emissions to peak around 2020, and subsequently decline by approximately 40% by 2050. The cost of such mitigation action is a loss of GDP relative to business as usual, projected to be roughly 0.5% by 2030, and rising to about 2.5% by 2050. This is equivalent to slowing annual growth rates in GDP over the 2005 to 2050 period by about 0.1%[46]. However, the cost of inaction would be significant, with some estimates suggesting damage costs in 2100 amounting to 23% of global world output[47].

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42 IPCC (2007), "Summary for Policymakers" in B. Metz et al. (eds), Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, United Kingdom and New York.

43 Kahn Ribeiro et al. (2007) "Transport and its infrastructure" in B. Metz et al. (eds), Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, United Kingdom and New York.

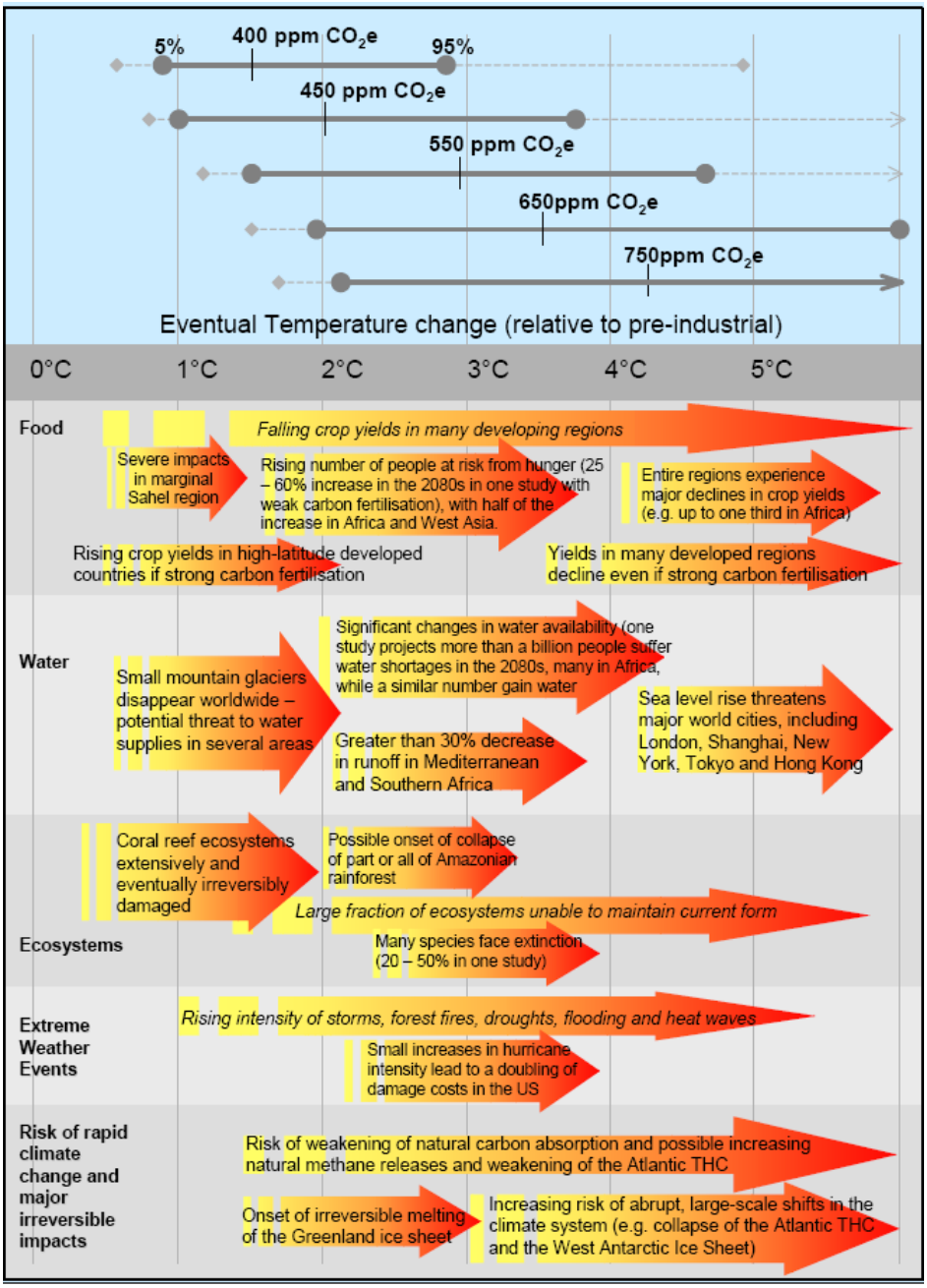
44 EC (2008), European Energy and Transport, Trends to 2030.

45 EEA (2008), Greenhouse gas emission trends and projections in Europe 2008, EEA Report No 5/2008.

46 OECD (2008), OECD Environmental Outlook to 2030, OECD, Paris.

47 Kemfert, C. and K. Schumacher (2005), Costs of Inaction and Costs of Action in Climate Protection, DIW Berlin Final Report of Project FKZ 904 41 362 for the German Federal Ministry of the Environment in OECD (2008), OECD Environmental Outlook to 2030, OECD, Paris.

Graph 17. Consequences of climate change



Source: Stern, N. (2007), The Economics of Climate Change The Stern Review, Cambridge University Press, Cambridge. Figure 13.4 'Stabilisation levels and probability ranges for temperature increases' p.330.

3.7. Technology

83. **Technology, including product and operational innovation, is likely to transform the global economy in the decades to 2050**. Although it is uncertain whether science can deliver new technologies in time to satisfy social, economic and environmental needs and which technologies will be pre-dominant, it is right to assume a certain amount of progress, including some probability of technological breakthroughs, in already existing technologies, and the emergence of new fields. On the transport side, technology can be expected to influence the sector in many ways. It will affect the demand for transport by modifying the needs of people and of the economy. It will also transform the supply of transport, through changes in the organisation, in the infrastructure and in the vehicles.

84. **Advances in information and communication technologies (ICT) and extensive application of the Galileo programme would lead to further optimisation** along the logistics chain, and a possibly more dematerialised economy, where the need for physical movement of people and goods is reduced by the expansion of e-commerce and tele-working. However, it is uncertain whether this trend would be counter-balanced by the proliferation of new life and work-styles enabled by mobile and always-on connectivity.

85. In parallel with the fall of the average household size to 2.3 by 2050[48] (from 2.5 in 2001) in the EU, **outsourcing of tasks traditionally undertaken inside the households** to external service providers is expected to continue. At the same time, technology would further enable individuals to perform tasks which formerly required special skills and had higher costs associated, leading to the expansion of the 'self-service economy'.

86. Wide deployment of already existing technologies for improving energy efficiency of vehicles and exploiting different forms of renewable energy will be the basis of development in the energy and transport sectors in the medium-term. The human desire for higher speed and safety will remain and contribute to various new ways of transportation that would have to take into account energy efficiency (and possible scarcity). Concerns about energy security would likely encourage the **development of decentralised energy production**, thereby decreasing the need to transport fossil-fuels which currently represents around 50%[49] of the volume of international shipping. Increases in fossil fuel prices would further stimulate research in renewable energy technologies and enable wider spread of alternative fuels.

87. Although there are still technical and non-technical barriers to overcome before **fuel cell and hydrogen technology** is commercially viable, some projections suggest that by relying on hydrogen end-use applications in passenger cars, light duty vehicles and city buses, 50% of road transport demand would be covered by 2050[50].

88. In order to fulfil the needs of new types of vehicles, such as hydrogen cars, maglev trains and podcars, energy and transport infrastructure would need to be built, and further innovation in the organisation of transport would need to be realised. More and more infrastructure will make use of composite materials, thus abating costs in construction and maintenance. However, **the costs associated with such additional investments**, also inflated by limitations on land use in dense urban areas, **might discourage technological development and large-scale deployment**, leading to a 'chicken and egg' problem.

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48 SEC(2008) 2911

49 The share of fossil fuels among the main commodities traded in the world by sea is around 51%, constituting from crude oil (32%), oil products (8%) and coal (11%) (based on billions of ton-miles, 2005 figures, source: UNCTAD) .

50 Projections by HyWays (European Hydrogen Energy Roadmap); http://www.HyWays.de

4. WHAT TYPE OF SOCIETY ARE THE CURRENT TRENDS LEADING TO?

89. The following paragraphs try to describe the type of economy and society that would emerge in the future as a result of the trends described in the previous section. This, however, does not represent a probable scenario, since the contradictions, bottlenecks and trade-offs that are likely to emerge, might break some of those trends and shape a very different future. The aim of this chapter is precisely to try and provide some insights into the future challenges, so to better prepare a policy response.

90. **Living in a global world**. Europe in 2050 could be part of a world in which the economic differences with Asia have declined and the world economy is further integrated. The EU's foreign trade will overall grow more than GDP, especially with Russia and North Africa. Currently less developed areas of the world such as Africa could become more important in terms of world trade and would attract significant foreign investment. Economic growth in other parts of the world will likely be higher than in Europe where GDP is expected to grow at 1.7% per year, or possibly close to 2% assuming the successful implementation of structural reforms (the Lisbon agenda)[51]. EU companies could settle in other parts of the world in order to have better access to local markets. Europe might retain a competitive edge in complex services and research based industries.

91. **Ageing society**. In 2050, EU society will be much older than today. This would bring about more financial resources being spent on pensions and health care. Compared with 2008, older people would probably travel much more. Scientific progress could help reduce health problems and people of 80+ could be more autonomous. Greater integration of social security schemes, specialisation in health services and greater knowledge of foreign languages could induce retired people to migrate or spend large part of their lives outside their home country. Some old people might look for higher purchasing power for their pensions by living in less well-off countries or travelling there for medical assistance. This might give rise to long distance travelling.

92. **Changed climate.** Europe's climate will be substantially different by the mid-century even if stringent climate change policies are put in place very soon. In the decades to 2050, extreme weather events such as storms, floods, droughts and heat-waves could lead to significant infrastructure damage (globally amounting to around 0.5% to 1% of world GDP per year[52]). Around a third of the EU's population mainly in Southern and Eastern Europe will be exposed to negative effects, mostly due to changes in precipitation and an increase in temperature, resulting in flooding, coastal erosion, land degradation, desertification and potential drought. These will have an impact on vulnerable economic sectors, such as tourism, large scale energy production, agriculture and fishery, and would make considerable investment in adaptation measures necessary.

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[51] Projected GDP growth figures for the period 2007-2060; source: DG ECFIN and the Economic Policy Committee: The 2009 Ageing Report: Underlying Assumptions and Projection Methodologies for the EU27 Member States (2007-2060) (European Economy 7/2008).

[52] Stern, N. (2007), The Economics of Climate Change The Stern Review, Cambridge University Press, Cambridge.

93. **A multicultural society**. Migration, partially driven by climate change, will have contributed to mitigating the ageing process of society. In general, migrants are young, have a higher fertility rate and they live in cities. Social inclusion of new migrants would be a key issue affecting housing and transport conditions in suburban areas.

94. **Concentration of human activities in 'dense' areas.** A significant part of the population is expected to live in 'mega cities' which have become major regional centres. The most successful of these regions would combine congestion charging for car use with new or renovated mass transit systems in combination with strict land use policy to curb congestion. Mobility and accessibility would become important parameters for decisions of localization.

95. **Europe and its neighbours**. The relationships between the EU and neighbouring countries will likely be stronger. Migration would create further ties with North African countries. The Mediterranean Union could deepen and the EU could reinforce close partnerships with Eastern European countries.

96. **Energy production**. The global market price of fossil fuels, especially oil, could be more expensive in 2050 and the energy from renewable sources could become relatively cheaper than today. EU policies will have triggered a transition to a low-carbon economy. A very large proportion of energy in Europe could be produced in a more decentralised way from a variety of renewable sources.

97. **Technological breakthrough.** The majority of today's road vehicles and energy equipment (heating and cooling systems, industrial boilers) will be replaced by 2030[53]. Breakthroughs in information and communication technologies, low-carbon energy technologies, and vehicle technologies could transform people's lives. Oil might still be present in the energy mix, but with a much diminished role, possibly limited to certain transport applications.

5. CONSEQUENCES FOR TRANSPORT: FROM HERE TO THERE

5.1. General remarks

98. The development of the scenario highlighted in the previous chapter would create challenges for the transport sector for which answers would have to be developed along the way.

99. **The demand for mobility would grow**. Mobile jobs, migration flows and a more integrated society and economy would create the need for fast and reliable means of transport in order to keep Europe's competitive edge, and to be able to communicate with all parts of the world.

100. Increased ageing and dependency rate would reduce public resources for investments and maintenance of infrastructure. **The transport sector might be obliged to become increasingly more self-financed** through the 'user-pays' and 'polluter-pays' principles.

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[53] OECD/IEA (2008) World Energy Outlook 2008.

101. **Growing demand for mobility would put a strain on existing infrastructures**. Major parts of the infrastructure constructed in the second half of the 20th century has reached an age in which major repairs, upgrading or complete renewal become necessary. This will stretch public finances, although the introduction of new, composite materials will facilitate cost abatement. Insufficient funding for maintenance and major repair could lead to a reduction in capacity on certain road stretches in the form of speed reduction and/or restrictions on heavy goods vehicles, contributing to congestion on alternative routes in the network and ultimately to higher transport costs.

102. The cost of travelling might be further aggravated by the need to decarbonise the economy[54]. Higher transport costs would encourage further technological development. More efficient vehicles in all modes, improved logistics and wider application of ICT to transport in the form of intelligent transport systems will be deployed to enhance transport efficiency, sustainability, safety and security. Such a response would probably enable the satisfaction of an increased demand for mobility at affordable prices. Altogether, **it is difficult to anticipate whether the secular trend in the reduction of transport costs will continue** or, rather, transport users would have to adapt to the end of an era of cheap, subsidised travel and publicly funded infrastructure.

103. **New transport systems** will appear initially as demonstration projects which would combine the advantages of existing modes and make use of existing infrastructure. The uncertainties involved in the energy transition and the technology revolution would make that investment in new transport technologies become very risky, notably because networks tend to work on the basis of collaborative environment. Consequently, the difficulty to reach common international standards and financing under highly risky conditions would remain the main constraints of wide deployment and might eventually slow down technological development.

104. Change and adaptation will also be slowed down as a consequence of the **low responsiveness in transport infrastructure and vehicles that is due to their relative long life span**. This is related to the basic types of innovation: fundamental, in the sense of new networks and radically new technologies – versus adaptive, focussed on increasing the performance of existing infrastructure, vehicles or engines. The very high costs of fully new infrastructure may explain why certain transport solutions that present a number of relative advantages – such as maglev trains – have slower diffusion than some had expected.

5.2. Intra-urban transport

105. Urban traffic and congestion is expected to grow as a consequence of increased urbanisation and greater urban sprawl[55]. Congestion reduces the logistic efficiency of

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[54] According to OECD estimates, to limit global mean temperature change compared to pre-industrial level to near 2°C would require policies equivalent to implementing a global carbon tax gradually increasing from USD 2.4 per ton of CO_2-eq in 2010 to around USD 155 (constant 2001 USD) by 2050. Source: OECD (2008), OECD Environmental Outlook to 2030, OECD, Paris.

[55] There may be a trend towards concentration of ageing people in cities to profit from good and accessible health service centres. Immigrant population will be attracted to them by the concentration of economic activity. Socially excluded groups may also move to cities to benefit from their social attention services.

deliveries because of delays, increased fuel use and lower workforce productivity. **Transport would thus more and more suffer from the 'last mile' problem**, i.e. the difficulty in reproducing in individual deliveries the advantages that the consolidation of large volumes of transport can achieve over the long distances. The global competitiveness of European cities would suffer without proper investment, innovation and prioritisation of collective transport, including taxis. The role of dedicated lanes and multimodal interfaces could increase, as a tool to optimise transport/travel systems.

106. Cities may not be able to accommodate much larger volumes of private cars as infrastructure space to drive and park may be limited, also causing difficulties to build new infrastructure for public transport or alternative means of transport. **Many cities might have to find radical ways of dealing with congestion** to avoid episodes of total saturation.

107. Most transport, both passenger and freight, starts and ends in urban areas and by-passes several urban areas on its way. Hence, **urban traffic and congestion have an important impact on the daily life of cities and also on long distance transport**. As urbanisation and congestion grow, local traffic interferes with transit traffic. There would be increasing competition for the use of infrastructure between commuter, high speed and freight trains; and between trucks, buses, coaches and private cars.

108. **Heterogeneous behaviour patterns of freight and passenger vehicles and of short distance and long distance traffic increase the risk of accidents** which in turn would aggravate non-recurrent congestion and make transport less reliable. Both competitiveness and durability would suffer.

109. The **development of information and communication technologies** would provide universal and easy access to information and wide-spread electronic ticketing. This would not only help improving transport safety and facilitate better routing and logistics. It would also support the integration of various transport modes (co-modality) and the use of collective transport.

110. Ageing and migration would produce more diverse societies. Transport systems and modes would have to cater for the needs of increasingly heterogeneous social groups with different income levels, quality requirements and attitudes. The use of collective transport would depend on the amount of 'captive' customers and on its competitiveness in terms of cost, speed, reliability and comfort, as well as on its ability to provide solutions comparable in performance to the use of individual modes. Expensive mass transit systems would have to be supported by extensive land use planning. Experience of several European cities (Lyon, Karlsruhe, Strasbourg) shows that **where public transport and slow modes are provided with modern infrastructures and modern services, they gain significant market shares**.

111. In the future, there will still be parts of the population who will not be able to produce their own transport services or make use of ordinary public transport. That goes above all for the elderly, the physically and mentally disabled and to some extent for young children. For these different groups, there has to be a defined **right to mobility** and a tailored transport service to secure that these groups stay connected to society.

112. **Travelling choices would reflect the needs of an ageing population**:

- The level of perceived security, environmental awareness and affordability would play an important role in personal decisions.
- An ageing population raised in the Internet era may favour on-line purchases and home deliveries. Extensive e-commerce could contribute to a reduction in transport.
- Retired people or aged employees with more flexible working arrangements could be induced by appropriate policies to travel off-peak.

113. Higher fossil fuel prices, together with stricter climate change mitigation and pollution reduction targets would lead to **improved light-duty vehicle fuel efficiency and wide-spread electrification**. Urban-use trucks would also achieve substantial fuel efficiency improvements through hybridisation. After 2030, hydrogen fuel cell vehicles might become a viable alternative, especially for buses operating a shorter distance[56]. However these technological shifts would require substantial investment in appropriate distribution infrastructures.

5.3. Interurban freight transport

114. **Transport cost would develop according to opposing forces**. On the one hand, there would be higher costs for energy, infrastructure maintenance and development, and environmental externalities. Labour costs might also increase as a consequence of ageing: the lack of skilled labour which is already felt in many transport modes (road, maritime[57]) could be further aggravated. On the other hand, there would be further efficiency gains brought by technology, by further market opening and the completion of the Single Market, and by efficient pricing schemes.

115. In any event, the cost of transport is not likely to outweigh the savings that transport allows in terms of labour or inventory costs. As a consequence, **the trend of increasing demand for long distance freight transport is unlikely to reverse**.

116. **The logistics sector would be creating more flexible, but complex networks** using advanced logistics concepts such as hybrid supply chains, collaborative networks (wherein different producers are cooperating in transport in order to achieve economies of scale), e-logistics (both business-to-consumers and business-to-business) and return logistics. These more complex logistics products would be necessary to deal with increased individualized market demand and quicker passing of new fashions. This would have an effect on light vehicle growth figures (vans) and would exceed the growth of other categories.

117. As a consequence of climate change, summer sea ice could completely disappear in the Arctic Ocean somewhere between 2013 and 2040[58], cutting the length of

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56 OECD/IEA. (2008) Energy and Technology Perspectives 2008. Scenarios & Strategies to 2050.

57 According to BIMCO projections, a deficit of 27,000 officers (5.9% of the total) may occur by 2015, if the number of vessels in the world fleet is to increase by 1% and recruitment and retirement patterns remain unchanged. Source: Lloyds Register – Fairplay Research, Benchmarking strategic options for the EU Maritime Transport System in the horizon 2008-2018 (OPTIMAR), 2008.

58 WWF, Climate change: faster, stronger, sooner, A European Update of climate science, 20 October 2008.

Europe-East Asia **shipping routes** by up to 40%. Silk routes such as the TRACECA corridor may also become an economically viable alternative.

118. **Large intercontinental ports might reach high congestion levels** due to further globalisation. Their hinterland connections might become frequently clogged as a result of the unloading of giant containerships. Meanwhile smaller ports may present spare capacities if not integrated in the established circuits.

119. **For ships, energy intensities would be reduced by up to 30% by 2050** through more efficient engine and propulsion systems and ship design[59].

120. The emergence of **a European network of rail freight corridors** through cross-border cooperation **and increased competition in the railway markets would facilitate enlarging the share of rail in freight transport**. A hub and spoke system wherein major production/consumption areas are linked to each other in Europe would help. However, whilst its advantages in intercontinental traffic are clear, a hub and spoke system has also shortcomings in servicing more restricted areas.

121. **Rail freight vehicles would very likely become longer, bigger and more energy efficient**. Enhanced technology and improved rail infrastructure may allow longer trains, cheaper rail transport and increased co-modality.

122. **Trucks, ships and aircrafts would increasingly rely on alternative fuels** whose production would start to affect the price of oil after the introduction of the second generation biofuels. The shift away from fossil fuels would be encouraged through stringent environmental regulation, most likely reflecting the external costs of transportation, and concerns about the security of supply of fossil fuels.

5.4. Interurban passenger transport

123. **Long distance passenger travel would increase as a consequence of globalisation, tourism, regional integration and migration**. The latter will increase labour and business related mobility, and the connected social mobility (families, friends). Moreover, rising incomes, ageing and lower transport costs would increase leisure travel. Large intercontinental airports (hubs) might reach high congestion levels due to further globalisation. At the same time smaller regional airports may present spare capacities and become more integrated. Distances travelled would also increase involving demands for higher comfort and a suitable handling of luggage.

124. **If considerably higher transport cost materialised, this could start a vicious circle in rural areas** which could imply closing of shops and services, accelerated migration, depopulation and further reduction of transport services.

125. High speed rail would be able to move even faster than today and could provide a significant share of journeys for distances up to 700-800 km. However, high speed rail would only impact air traffic in limited geographical markets, where air is often unable to compete except for interlining. In addition, without subsidies, it is possible that end-user prices for high speed rail travel may increase. Nevertheless, high speed

[59] OECD/IEA (2008), Energy and Technology Perspectives 2008, Scenarios & Strategies to 2050.

rail could take an increasing role in complementing air travel by connecting cities with airport hubs. **Increased co-modality of rail and air would offer alternative routes and more efficient transport**.

126. **The difference between the speed of freight and passenger rail transport would increase and would make the sharing of the same infrastructure more difficult**.

127. Interurban bus transport would in most areas be an important system connecting cities and supplementing rail and air transport to secure an area-wide service of public transport and mobility for that part of the population who does not have access to individual transport or does not wish to use it. New design, materials and development in engine technology would considerably lower fuel consumption per pkm. **Long distance bus and coach transport would be an important service for groups of the population with a low value of time**.

128. **Air transport could increasingly rely on biofuels**[60], but the transition would be rather slow, as in aeronautics it takes 5 to 10 years to develop a product, which has typically a 50 to 60 years life span. Nevertheless average energy fleet efficiency could be increased by at least 30% by 2050[61].

129. **Security would remain a general concern**, not only in air transport, but also in other transport modes such as high speed rail. Security checks would be developed which may increase transit time. This however may impact travelling convenience and decrease competitiveness of collective transport means, unless new mobile and non-intrusive technologies to conduct security checks are deployed.

6. MAIN SOURCES OF UNCERTAINTIES OF THE SCENARIO

130. Although the above described drivers indicate certain trends and consequences for transport, it should be acknowledged that complex interactions between the drivers could make the future of transport uncertain. In addition, the future of transport may be affected by factors which cannot easily be foreseen, but which may have an important impact on transport. Some of these factors are described below.

131. The geopolitical situation in Europe, in neighbouring countries and in other world regions could impact trade relations with Europe and thereby also transport flows. The outbreak of wars would be one obvious example to mention in this context. The **stability of the economy** is another factor, which – in the case of major fluctuations – may cause trend breaks in trade and in transport flows. This could happen at a worldwide level, but also at more regional levels resulting in shifts of trade between regions.

132. Growing inequality in welfare between countries/regions due to different economic evolutions could lead to **geopolitical instabilities** and result in increased flows of immigration, but also in conflicts (terrorism, war etc.).

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60 See e.g. "IATA environment stand inauguration at Rome Fiumicino Airport - Remarks of Giovanni Bisignani" IATA, 16 Jan 2009.

61 IATA airlines have adopted a voluntary fuel efficiency goal to reduce fuel consumption and CO2 consumption by at least 25% by 2020, compared to 2005 levels.

133. In contrast to the above point, the possible levelling out of current inequalities may likewise cause **major shift in trade patterns** and in transport. The timing will largely depend on how fast less developed countries will be able to catch-up and become competitive, and this will – among other things – depend on the support provided to less developed countries as well as on investments carried out by private entrepreneurs in these countries.

134. **Climate change can also be viewed as threat multiplier** that can exacerbate instability as its greatest impacts will be felt in regions that are already conflict prone. It is important to recognise that the risks are not just of humanitarian nature; they also include political and security risks that directly affect European interests[62].

135. Furthermore there is a possibility that global warming will trigger **non-linear changes in our climate** (at the so-called 'tipping points'), such as the onset of irreversible melting of the Greenland ice sheet or the weakening of the North Atlantic Thermohaline Circulation, which could have abrupt and potentially catastrophic impacts on whole regions[63].

136. The European social model and public services are financed by public funds. An ageing society may, as earlier mentioned, put a strain on public funds, and this raises the question of **the ability of the public sector to maintain the current European social model and level of public services**. The public sector may have to rationalise spending and concentrate on maximising general welfare, which could imply a reduction in subsidies of public services leading to price increases and/or certain services no longer to be maintained. Such a situation would have a dramatic impact on the provision and the use of public transport.

7. POLICIES THAT MIGHT IMPROVE TRANSPORT EVOLUTIONS – TOWARDS A DESIRABLE FUTURE

137. As discussed in previous chapters European high standards of living and welfare cannot be taken for granted. Scarce resources, including human ones, have to be put to their best use to improve competitiveness and sustainability. The trend is towards a highly connected, highly skilled society, but this must be at a low cost for society and for the environment. In particular **sustainability requires a policy-created break in trends**. To focus minds – copying from the well-known '20-20-20' objective for 2020 – this can imply an EU transport system that by 2050 produces 50% less CO_2 emissions, that it is only 50% dependent on fossil fuels, that has less than 5000 road fatalities per year, where citizens spend less than 50 minutes per day to commute to work and school.

138. The achievement of objectives like these will require action at all levels: infrastructure, vehicles, fuels, ITS equipment and users. **The magnitude in the break in trends sought requires making use of all available solutions**: better use of current vehicles and systems, modal shift when suitable – but extending the limits

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62 S113/08 (14 March 2008), Climate Change and International Security, Paper from the High Representative and the European Commission to the European Council.

63 Stern, N. (2007), The Economics of Climate Change The Stern Review, Cambridge University Press, Cambridge.

of such suitability – as well as the development of new vehicles, systems and infrastructures. It will also require changes in the way productive and social activities are organised and localised. Finally, it will also require an effort of persuasion to change the mindsets of citizens both as users and as voters.

139. However, it must be borne in mind that in some cases sustainable development objectives may jeopardise short term competitiveness objectives. The solution to the **trade-off** is not always easy as healthy economic growth is needed to generate the income needed to finance RTD programmes, infrastructure, equipment and the renewal of vehicle fleets towards cleaner vehicles.

140. This chapter will describe how the use of policy instruments could assist society in coming to terms with some of the transport challenges described in Chapter 5 and changing the course of the transport system to reach ambitious objectives such as an **inclusive society connected by an integrated and sustainable transport system**. The measures will be described at a relatively general level and without consideration of whether they should be enacted at local, national, EU, or even global level.

7.1. Towards an integrated transport system with integrated networks

141. Transport is a network industry which means that **there is a close relation between the infrastructure and the service it provides**, in some cases obliging to provide scheduled services (railways, aviation). A network offers connectivity and choice, but its infrastructure is expensive and has to be homogeneous to provide a continuity of service. The day to day efficiency of the system is provided by the operators who find the least costly way through the network, increasingly with the help of ITS. Within a given routing, a network is as strong as its weakest link, but being a web it also offers alternative routings, which makes it resilient to difficulties such as recurrent and non-recurrent congestion (due to accidents or maintenance work).

142. **Some of the challenges to a growing demand for mobility come from the existence of a network that is not integrated, it is often overloaded and it is sometimes obsolete**. The different transport modes have historically developed their networks independently of each other giving rise to intermodality frictions. Even within the same mode, would-be European systems are fragmented along national lines by legal and technical barriers. This is the case of the rail networks where a continental dimension is still something of the future, despite a number of steps forward which have taken place in the last ten years. Moreover there are also frictions in the competition between vehicles for the use of the same infrastructure in particular between passenger and freight transport. These rigidities restrict choice possibilities and lower the efficiency of the system by producing energy losses and waste of time.

143. **One of the most critical 'friction' points in a network is the node** which is the point where the user or the load joins the network and where different loading and accommodation operations take place. It is also the place where delays, missed transfers and postponements happen, or where luggage is lost and passengers feel utterly disoriented. The technology and organisation of nodes has to be radically improved to make boarding and transhipment much easier.

144. The advantage of a network is the repetition of familiar patterns, something the international passenger often misses in a node. As in the case of any retailing

franchises, this does not amount to a 'one size fits all' approach as public transport facilities and interchanges offer room for customisation to cater for different needs. **Progress in logistics has largely concentrated on the transport of goods, which needs are largely different from those of passenger transport**.

145. The policies that appear more capable of easing the transport constraints are those that will **facilitate the creation of a fully integrated, modern and reliable transport network, capable of exploiting the strengths of each mode, in its own and in combination, and of accommodating the technological progress**. Public authorities, operators and infrastructure managers must strive to make alternative modes and co-modal transport more attractive to end-users.

146. **When devising other policies there are consequences for transport that should be taken into account**. All human activities have a space and territorial dimension which mobility binds together. The production of 'things' in a farm or factory is more space dependent than the production of 'ideas' in an office or school. Roads are provided in the belief that citizens and firms will take care of their mobility needs with their own means. However, with increasing congestion this is no longer possible. Transport and location solutions have to be jointly provided to allow the movement of large amounts of people, carrying out a large variety of activities in many different places. The need to concentrate people and goods in factories, offices, schools, hospitals and the like has to be assessed in the light of the mobility needs it will create. Collective mobility has to be planned as a part and parcel of the collective realisation of activities. Alternatives to people concentration start to appear: flexibility has started to permeate timetables and there is a new bundling of working place and living place, in particular for 'idea-intensive' activities and professions.

7.2. Infrastructure policy

147. **It is important to reflect at the positive externalities of transport** and at the risk that transport is neglected in the use of scarce public resources. The availability of a modern infrastructure, to cater for the needs of citizens and firms, is a public good and a source of positive externalities.

148. To the extent that transport demand is projected to grow, existing infrastructure will become scarce. **Public authorities will have to consider to which extent to apply the user-pays** (and the polluter-pays) **principle and to allocate public funds to maintain and develop infrastructure**. These funds will compensate for the general socio-economic benefits of infrastructure so as to guarantee the efficient performance and competitiveness of the European transport sector.

149. **Funding of infrastructure calls for careful consideration of priorities including ITS applications to ensure a more efficient use of the network**. Priorities differ between EU 15 (trans-modal platforms, multimodal passenger terminals, solutions for congested corridors) and EU 12 (more basic infrastructure, missing links). Some other trend-breaking priorities, like the promotion of slow modes (e.g. dedicated paths for bicycles), are common to all Member States.

150. Owing to the scarcity of public funds, **there is a need for private sector involvement in the financing of infrastructure**. It is important, in this regard, that private operators are given the incentive to invest in infrastructure and that proper conditions are put in place for this to happen (e.g. risk sharing).

151. **Private involvement works well in a well-planned system and within a clear legal and regulatory framework**. So far the most of the private involvement in transport infrastructures involved concession, a legal tool at the basis of the so called BOT (Build, Operate, Transfer) schemes. Although subject to a certain degree of European harmonization, concessions are still subject to a relevant number of national only regulations; more harmonized rules would be beneficial for a sector that depends on international investors, seeking for a reasonable stability and reliability.

152. **Planning of infrastructure plays a decisive role to ensure coherent and uniform development at a European level**. From the points of view of the internal market and of social cohesion it is important to provide efficient infrastructure to link agglomerations and also rural areas to avoid rural depopulation and regional disparities. Infrastructure should be built where there is a real need according to project assessment practices that take into account its economic growth generation capacity e.g. effects on competition.

153. Progress in infrastructure construction, from tunnelling to ICT intelligent infrastructures, will allow reducing environmental impacts and improving efficiency. Conversely, **infrastructure should be designed in a way that it stimulates the use of environmentally friendly energy sources**. For instance, railways could focus on uninterrupted electrification for major corridors. Highways should develop long distance green corridors where there is uninterrupted availability of biofuels. Charging points for electrical or plug-in hybrid cars must be made available at strategic locations for short distance transport.

154. The **planning of infrastructure should be pro-active and integrated with land planning and transport solutions**; e.g. when relocating companies to industrial zones and business parks outside of cities, collective transport solutions should be developed for the travelling of employees. Urban planning and industrial location permits for all kind of activities, beyond a certain threshold, should include a mobility audit. Conversely, the planning of infrastructure and in particular intermodal platforms and passenger interchanges has to take on board the needs of economic development and social cohesion.

155. **In some cases the dedication or prioritisation of parts of the network to either passengers or freight has proven efficient** (ex. green corridors in cities for collective passenger, including taxis and visiting coaches; creation of dedicated rail lines to freight or high speed passengers), **in other cases restrictions hamper the full use of capacity** (ban on night deliveries, week end driving restrictions, etc).

156. **Much can be done to improve co-modality**: ex. user friendly terminals for passengers where all modes are connecting; a common ticketing system including common and integrated ticketing air-rail-local transport; rail and car rental combinations; freight platforms at the outskirts of towns to make deliveries to and from cities more efficient; self-guided ‘hectometric’ passenger transport etc.

7.3. Pricing schemes and market efficiency measures

157. **There cannot be economic efficiency unless prices reflect all costs**. The internalisation of external costs is crucial, not only for its immediate effects, but also because it will raise users’ awareness and will provide long-term signals to investors: this will gradually transform the transport system.

158. **Pricing schemes produce a flow of revenues which should be swiftly reinserted into the economy where they may be used for different purposes**. The most obvious is the expansion of the infrastructure which is subject to charging or the allocation to these revenues to ITS or other improvements which allow an efficient use of the existing capacity. Incentives to promote the use of collective/public transport should also be implemented.

159. **Pricing schemes are more effective in modifying behaviour in the presence of valid transport alternatives**. Studies show that users have a great reluctance to change behaviour in relation to transport due to rigid short-term elasticities, as lifestyles are determined by long term choices (housing, jobs, vehicles etc).

160. To make the best possible use of the limited infrastructure capacity in the different modes, individual decision-makers have to be given the freedom to choose what they think is the best among different courses of action. They will do so guided by regulations or by economic instruments which reflect the public interest including the need to protect the citizens and the environment. **Taxes, charges and emissions trading systems (ETS) are economic instruments which can be tuned to cover external costs and which let users free to choose**.

161. ETS has the particular advantage of providing positive incentives, as users who save or don't use emission permits may sell them against a profit. However, it is a system which is hard to monitor and administer. For this reasons it requires a relatively limited amount of market participants, which makes it more suitable to maritime transport or aviation than for road transport, which is highly atomised. If the ETS system is not applied at the level of final fuel consumers, it replicates the characteristics of a tax.

162. Taxation is an effective instrument in orientating consumers' choices. **The relatively high energy efficiency of the road vehicles driven in Europe is largely due to the high taxation of fuel**. Taxation is however less effective when disconnected from the behaviour to be discouraged; that is the case of fixed charges (e.g. registration taxes) that are not related to the driven kilometres or to the environmental characteristics of the vehicle.

163. Public subsidies are another economic instrument often used in transport with various aims. When they address environmental objectives – e.g. by supporting less polluting modes – they run the risk of altering pricing signals which should rather reflect systematically internal and external costs. **Subsidies can however be useful in correcting other types of market failures**, for example for the provision of public goods (such as open infrastructure, basic research, etc.). Subsidies are also given in connection to Public Service Obligations, typically to allow transport services of public utility that would not be commercially profitable, for example regular connections with remote regions.

7.4. Market opening, regulation and other public policies

164. **Efficiencies and better use of network can also be achieved through a liberalisation process that facilitates market entry and reduces administrative barriers**. E.g. in its report on the EU, the OECD recommends to 'keep pushing for an EU port policy that includes greater transparency and market access'. In road transport empty returns would be reduced by increasing cabotage possibilities

(harmonisation allowing) and by reducing own account transport; electronic freight documents could ensure seamless transfers between transport modes; etc. In the rail sector positive effects for consumers could be achieved by the completion of market opening of rail passenger transport, i.e. by opening to competition ('in the market' or 'for the market') national passenger transport in the near future.

165. In the presence of market failures that cannot be easily corrected, market based instruments might not be effective and regulation may be more appropriate (driving bans, emission standards for vehicles, etc.). However, **regulations should be adjusted to remove the considerable barriers to a level playing field in the transport sector**. Especially in the context of intermodal and international competition, there is still a multiplicity of distortions by different legal frameworks in taxation and in passenger rights. Bans and regulations should be flexible enough to adapt to changing circumstances.

166. **Safety and security are important aspects of transport activities** and new or updated regulations will have a significant impact on transport demand and on the answer given by the operators to these needs. An increased political focus on safety and security is very likely to occur. However, security requirements, both for freight and passenger transport, might represent a significant impediment to a seamless European transport network. A balanced approach will have to be found with other elements such as ease of travel, privacy concerns and costs.

7.5. Information, training and education

167. Incomplete information is a big obstacle towards efficient use and integration of networks. **Users should be provided with simple and reliable information** to be able to make choices on the best use of infrastructure.

168. Development of information technology can be of great help, but it might need considerable efforts in developing **common standards** (syntax, presentation of information, etc).

169. The ability of the transport sector to take advantage of inward immigration to counter labour shortages and to optimise the productivity of an ageing workforce will depend on the **accessibility and affordability of training** for European companies.

170. **Education is an important policy tool both for innovation purposes and for nurturing more sustainable transport user and planning behaviour**. Change in behaviour starts in the mind of people. A change in transport behaviour towards more sustainable choices can be initiated by targeted information and awareness awakening campaigns as is well-known from traffic safety and energy saving campaigns. This could be supplemented with obligatory training measures as a prerequisite for obtaining a drivers license and targeted initiatives on professional drivers. Integration of transport and sustainability in the curriculum at different levels is another way to stimulate and consolidate the necessary transition in transport behaviour and to nurture new ideas.

7.6. RTD policy

171. **An increase in funds for research has to take place** in particular concerning energy solutions and ITS as well as and for the development of technologies for door-to-door intermodal transport. More fundamental research should be done in partnership with industry as with the current Joint Technology Initiatives.

172. **A balance should be established between financial support to upstream R&D and to downstream technology integration, validation and implementation**. EU upstream collaborative research should not be sacrificed to short term effectiveness because futuristic concepts will be needed more than ever, which does require 'blue-sky' thinking as from today. Sources of investment for free innovation are needed and upstream research needs to be reactivated.

173. Complementarities and synergies between upstream and downstream research activities have to be ensured notably by providing support to **demonstration activities and to standardisation all with the support of adequate benchmarking practices**. Financial support to demonstration projects is required since projects are typically very costly. Standardisation needs to follow in order to allow for economies of scale and therefore lower production costs.

174. There are very many concept and ideas for innovative transport, but eventually only a few standard solutions can be adopted. It is therefore advisable to make **comparative studies of such solutions with the purpose of selecting best practices and thereby focus resources** on the most promising projects. In doing so it is important not to pick winners, but to allow for the development of several alternative solutions.

8. CONCLUSIONS

175. The discussions in the three different focus groups have signalled a general agreement on some of the major challenges that the transport system as a whole will be facing to a growing extent in the next decades. There is a clear perception that the need to address climate change and the depletion of fossil fuels will put strain on the transport system. This is compounded by the problem of congestion and limitation of infrastructure. There is a clear awareness that these issues will act in the future as qualitative 'new' constraints on securing accessibility and a high degree of mobility for business and people across Europe, and on the competitiveness of the transport industry and of Europe as whole.

176. More generally, the participants in the focus group shared the feeling that the transport system has come to a transition point towards a substantially new order, hopefully capable of dealing with the above-mentioned challenges. The transition calls for new policy initiatives to shape and encourage **technological development, behavioural change and infrastructure provision**.

177. A major part of the focus groups participants recommended an **intensified support to R&D** in order to secure that Europe can be on the forefront in the development of new and innovative transport technologies, i.e. alternative engine and fuels, light weight vehicles and application of ICT. Development of technology was seen as a critical factor for coping with the environmental constraints. Some members of the

focus groups also stressed the importance to support large scale implementation of new technologies.

178. Other members of the focus groups were of the opinion that the technological development probably would not be sufficient to meet the environmental challenges. **A change in behaviour towards less energy intensive means of transport and less energy intensive logistic solutions would have to supplement the technological development**. There was a broad agreement that demand management, notably through a greater use of pricing to internalise external costs backed by progress in ITS, but also through information and education campaigns, could help reduce energy consumption and emissions. Some members also stressed the need for long-term land use planning especially in urban conurbations.

179. Many experts have identified the urban context as the one posing the main challenges to transport policies from both a sustainability (CO_2, air pollution) and competitiveness viewpoint (congestion). **The more radical changes in the way transport is organised are likely to be needed in the cities and in the large agglomerations**. This will have an impact on the overall design of the transport system.

180. Other members mentioned areas of Europe where the main problem of **securing accessibility and mobility** is the lack of infrastructure and of access to the major markets.

181. Some members of the groups stressed the role of public authorities – which they consider essential in providing the planning, the funding and the regulatory framework for a complex system such as that of transport. It was observed that transport planning, network economics and regional development, all involve complex interactions of factors which require a substantial knowledge base to allow for the political, economic, social and technical aspects to be integrated into a policy framework. **There is need to extend the knowledge base, the evidence base and the practice base**. Policy is much needed in transport, but ill-designed policies can have very harmful and long-lasting consequences. Other participants emphasised the greater effectiveness and reliability of market based instruments and the need to provide correct signals and incentives to market operators.

182. This report cannot, unfortunately, give a full account of the many and constructive ideas raised in the discussion of the Focus Groups. The Commission will draw extensively on these ideas and point of views, as well as on the various other contributions received from interested parties, in the preparation of the forthcoming Communication on the Future of Transport.

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