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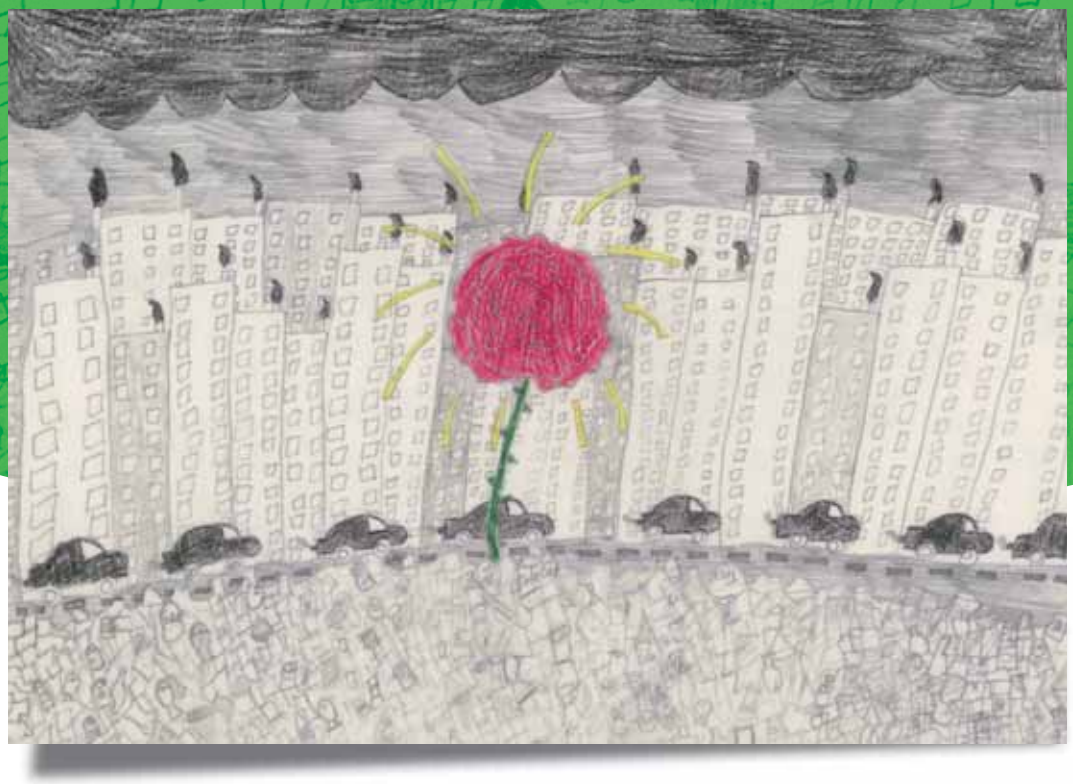
Transport, Health and Environment:
Trends and Developments in the UNECE-WHO European Region (1997–2007)



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Transport, Health and Environment:
Trends and Developments in the UNECE-WHO European Region (1997–2007)

Prepared under the auspices of the Transport, Health and Environment Pan-European Programme

Celia Molkentin (grade 60)

UNITED NATIONS
New York and Geneva, 2008

Note

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Acknowledgements

This report was developed by Louise Grenier (Grontmij/Carl Bro, Denmark) and Nick Cavill (Cavill Associates, United Kingdom) in collaboration with THE PEP joint secretariat (Jaromir Cekota, Sonja Kahlmeier, Martin Magold, Miodrag Pesut, Francesca Racioppi, Christina von Schweinichen and Brinda Wachs) for submission to the Third High-level Meeting on Transport, Health and Environment in January 2009. Contributions have also been made by THE PEP Bureau and THE PEP Steering Committee. The development of this report was supported by the Government of the United Kingdom of Great Britain and Northern Ireland.

The drawings and paintings featured in this report were selected from a design competition at the International School of Geneva, La Chataigneraie (Founex, Switzerland) and will be exhibited at the Third High-level Meeting on Transport, Health and Environment (22-23 January 2009, Amsterdam).

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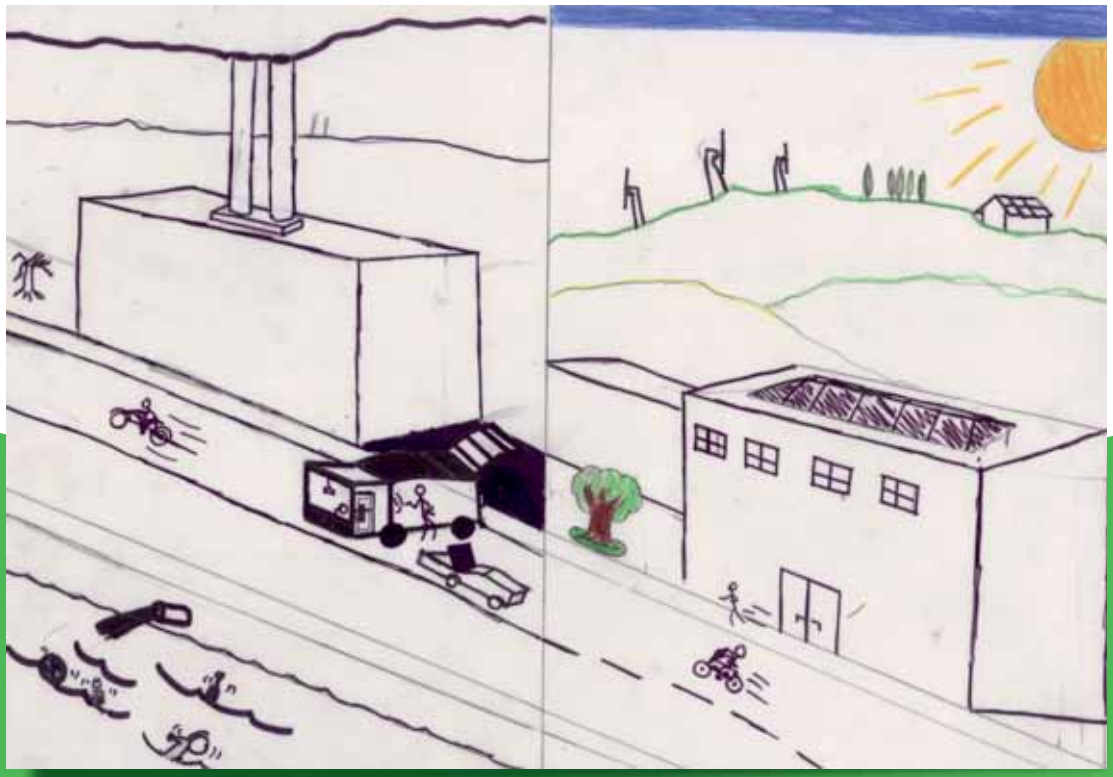
Abbreviations

Bel	Unit of level when the base of the logarithm is ten, and the quantities concerned are proportional to power; unit symbol B
CAFE	European Commission's Clean Air for Europe Programme
CEE (=CSEC)	Central and Eastern Europe: Albania, Bosnia and Herzegovina, Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Montenegro, Poland, Romania, Serbia, Slovakia, Slovenia and the former Yugoslav Republic of Macedonia (16 countries)
CEI	Central European Initiative: Albania, Austria, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, the Czech Republic, Hungary, Italy, the Republic of Moldova, Poland, Romania, the Slovakia, Slovenia, the former Yugoslav Republic of Macedonia and Ukraine (16 countries)
CIS (=EECCA)	Commonwealth of Independent States: Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, the Republic of Moldova, the Russian Federation, Tajikistan, Turkmenistan, Ukraine and Uzbekistan (12 countries)
CLRTAP	Convention on Long-range Transboundary Air Pollution
CO	Carbon monoxide
CO_2	Carbon dioxide
CSEC (=CEE)	Central and south-Eastern countries: Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Montenegro, Poland, Romania, Serbia, Slovakia, Slovenia, the former Yugoslav Republic of Macedonia and Turkey (19 countries)
dB	Decibel, one-tenth of a Bel
EBRD	European Bank for Reconstruction and Development
EC	European Commission
ECMT (=ITF)	European Conference of Ministers of Transport (reorganized as the International Transport Forum); member countries are Albania, Armenia, Austria, Azerbaijan, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, the Czech Republic, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Montenegro, the Netherlands, Norway, Poland, Portugal, the Republic of Moldova, Romania, the Russian Federation, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, the former Yugoslav Republic of Macedonia, Turkey, Ukraine and the United Kingdom of Great Britain and Northern Ireland (44 countries). There are seven Associate member countries (Australia, Canada, Japan, Korea, Mexico, New Zealand and the United States) and one observer country (Morocco).
EEA	European Environment Agency
EEA-17	EU-15, Norway and Iceland
EECCA (=CIS)	Eastern Europe, Caucasus and Central Asia: Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, the Republic of Moldova, the Russian Federation, Tajikistan, Turkmenistan, Ukraine and Uzbekistan (12 countries)
EFTA	European Free Trade Association; member countries are Iceland, Liechtenstein, Norway and Switzerland
EIA	Environmental impact assessment

EMEP	Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe; also one of the protocols to the Convention on Long-range Transboundary Air Pollution.
ENHIS	Environmental and Health Information System
ESCAP	United Nations Economic and Social Commission for Asia and the Pacific
EU	The European Union comprises the following 27 countries: Austria, Belgium, Bulgaria, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom of Great Britain and Northern Ireland
EU-10	The 10 countries which joined the European Union on 1 May 2004: Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia and Slovenia
EU-15	Countries in the European Union prior to the accession of 10 candidate countries on 1 May 2004: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the United Kingdom of Great Britain and Northern Ireland
EU-25	Countries of the European Union prior to the accession of Bulgaria and Romania on 1 January 2007
EU-27	See EU
EUR A	Subregion comprised of countries with very low adult mortality and very low child mortality: Andorra, Austria, Belgium, Croatia, the Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Israel, Italy, Luxembourg, Malta, Monaco, the Netherlands, Norway, Portugal, San Marino, Slovakia, Spain, Sweden, Switzerland and the United Kingdom of Great Britain and Northern Ireland (26 countries)
EUR B	Subregion comprised of countries with low child mortality and low adult mortality: Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, Bulgaria, Georgia, Kyrgyzstan, Montenegro, Poland, Romania, Serbia, Slovakia, Tajikistan, the former Yugoslav Republic of Macedonia, Turkey, Turkmenistan and Uzbekistan (18 countries)
EUR C	Subregion comprised of countries with low child mortality and high adult mortality: Belarus, Estonia, Hungary, Kazakhstan, Latvia, Lithuania, the Republic of Moldova, the Russian Federation and Ukraine (9 countries)
GDP	Gross domestic product
GHG	Greenhouse gas
IBRD	International Bank for Reconstruction and Development
IDA	International Development Association
IEA	International Energy Agency
IPPC	Integrated Pollution Prevention and Control
ITF	International Transport Forum
km	Kilometres
km/h	Kilometres per hour
$LA_{eq,T}$	A-weighted equivalent sound pressure level for period T
LA_{max}	Maximum A-weighted sound pressure level in a stated interval
MACs	Maximum allowable concentrations
MMT	Methylcyclopentadienyl manganese tricarbonyl (a gasoline additive)
NGO	Non-governmental organization

NIIAT	Scientific and Research Institute of Road Transport (Russian Federation)
NO_2	Nitrogen dioxide
NO_x	Nitrogen oxides
NWE	North-Western Europe
OECD	Organisation for Economic Co-operation and Development; member countries are Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, Slovakia, Spain, Sweden, Switzerland, Turkey, the United Kingdom of great Britain and Northern Ireland and the United States of America (30 countries)
OSCE	Organization for Security and Co-operation in Europe
PCFV	Partnership for Clean Fuels and Vehicles
p-km	Passenger-kilometre
PM	Particulate matter
$PM_{2.5}$	Particulate matter with a diameter of 2.5 µm or less
PM_{10}	Particulate matter with a diameter of 10 µm or less
POPs	Persistent organic pollutants
ppm	Parts per million
PPP	Purchasing power parity
REC	Regional Environmental Center for Central and Eastern Europe
SEA	Strategic environmental assessment
SEE (9)	South-Eastern Europe: Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Montenegro, Romania, Serbia, the former Yugoslav Republic of Macedonia and Turkey (9 countries)
SEE (6)	South-Eastern Europe: Albania, Bosnia and Herzegovina, Croatia, Montenegro, Serbia and the former Yugoslav Republic of Macedonia (6 countries)
SO_2	Sulphur dioxide
TERM	Transport and Environment Reporting Mechanism
THE PEP	Transport, Health and Environment Pan-European Programme
t-km	Ton-kilometre (transport of one ton over one kilometre)
toe	Ton of oil equivalent
TREN	Trans-European Network (of EU)
TSP	Total suspended particulate
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
VAT	Value-added tax
VOCs	Volatile organic compounds
WHO	World Health Organization
WHO Europe	WHO Regional Office for Europe



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Executive summary

General trends in transport across the UNECE-WHO European region

The present report reviews developments and progress in transport, health and environment since 1997. While transportation is an integral part of economic and social development and is essential to the functioning of all societies, the report shows that current patterns of transport and travel are not sustainable with increasing pressures, in particular on urban areas. These include the negative effects on health and ecosystems of transport-related air pollution and noise, greenhouse gas (GHG) emissions, congestion, road traffic accidents and other effects.

The integration of European economies and societies during this period has been accompanied by significant economic and social development. Transport, particularly international freight and passenger transport, has increased steadily in the last decades and has made a considerable contribution to economic growth. There has been extensive building of new roads and motorways across Europe, with the overall length of motorways in the European Union-25 (EU-25) growing by 38 per cent between 1990 and 2003. In the 10 countries which acceded to the EU in 2004, this growth was more pronounced, at 75 per cent during the same period. In Eastern Europe, Caucasus and Central Asia (EECCA) and South-Eastern Europe (SEE), the length of newly constructed motorways was even more remarkable, at 144 per cent and 157 per cent respectively. During the same period, the length of railway network and inland waterways has seen declining trends across Europe.

In the EU, the volume of passenger and freight transport has more than doubled over the past 25 years. Road transport is also becoming more important in EECCA and SEE countries. Between 1995 and 2005, passenger transport in the EU-25 grew by an annual average rate of 1.8 per cent and freight transport by 2.8 per cent, while gross domestic product (GDP) grew by an average rate of 2.3 per cent in the same period. Conversely, passenger transport in EECCA and SEE declined sharply during the 1990s. Since 2000, however, while the number of vehicles has steadily grown, passenger and freight transport have picked up and reversed the downward trends. Freight transport is also recovering and freight volume is increasing, leading to increase of traffic congestion, especially in urban areas. It is predicted that road transport volumes and the number of road vehicles will continue to grow in the next decades. It seems likely that, with a few exceptions, the rates of walking and cycling are declining across the UNECE-WHO European region at the expense of travel by car, although there are few trend data available.

The use of public passenger transport (rail, buses and coaches) in EECCA experienced a substantial decline between 1990 and 2000, and subsequent recovery has been weak in most countries. A key factor behind the inability of public transport to recover from the decline of the 1990s has been the decrease in funding levels that many public transport systems in EECCA and SEE have experienced in the past 10 years. The use of private cars for transport has increased significantly over the last decade. However, the level of private car ownership, below 180 cars per thousand population in all EECCA countries, and below 290 in SEE, is still much lower than the typical values of 400 to 600 in Western Europe.

Trends and developments regarding effects of transport on health and the environment

Air quality

The fuel combustion processes in the transport sector produce several chemical compounds that impair air quality. Such compounds include nitrogen oxides (NO_x), sulphur dioxide (SO_2), carbon monoxide (CO), hydrocarbons and particulate matter (PM). Emissions of NO_x also have an impact on the volumes of ground-level ozone, which are harmful to the environment and to health. Impaired air quality is related to a number of negative health effects, especially of the respiratory and cardiovascular system; some air pollutants also have carcinogenic effects.

Air pollution costs are estimated at 2 per cent of GDP in high-income countries. Road transport is an important source of these emissions. Some 3.6 million of life years were lost due to exposure to air pollution in the EU-25 in the year 2000. The average loss of life expectancy from air pollution is 8.6 months. According to the National Public Health Institute of Finland estimates, as many as 2 million Finns suffer from occasional respiratory symptoms caused by airborne particles and 200 to 400 people die prematurely every year because of air pollution. In the Russian Federation, available data indicate that increased pollution from urban air causes

an estimated 40,000 additional deaths in urban areas. The average air pollution levels have not changed substantially in the last few years in most parts of Europe.

Air pollutant emissions, including transport-related ones, decreased in the 1990s in EECCA countries, mainly due to the economic recession, but less than the decrease in transport volumes, indicating a reduction in average fuel efficiency. With economic recovery, this decline has ceased. The increase in the number of vehicles, especially private ones, as well as in travel distances, is likely to offset technical improvements and to lead to increased levels of harmful emissions in the urban environment. In Moscow, motor vehicles were the main source of air pollution and transport was responsible for more than 80 per cent of all pollutants discharged. Cars contributed an estimated 65.5 per cent, trucks 25 per cent and buses 10 per cent of total air pollution from vehicles in 2003. In other EECCA and SEE countries, the situation is similar, with transport-related emissions increasing in urban areas after the period of decline or stagnation during the 1990s.

Road traffic casualties

Despite differences between countries, overall mortality rates from road traffic injuries have declined in Western Europe. In the EU-15, the number of road fatalities declined by 45 per cent between 1990 and 2005, and in the EU-25 the number of fatalities was reduced by 21 per cent between 2000 and 2005. The average mortality rates from road accidents in EECCA countries are higher than in the EU-15 and in Central and Eastern European countries. Although the mortality rate declined by 23 per cent in 1991 to 15 per cent (per 100,000 population), it is still higher in EECCA than in the EU-15 (10% and 13% per 100,000 population, respectively, in the EU-15 and in Central and South-Eastern Europe in 2000).

From the mid-1990s to 2000, road traffic fatalities declined in several EECCA and SEE countries, probably due to the economic recession (since lower economic growth is correlated with lower transport volumes) rather than to road safety strategies. From 2000 to 2004–2005, SEE countries showed a slight decrease in the number of persons killed in traffic. The situation differs in EECCA, in particular in the Russian Federation, with a 22 per cent increase in persons killed in road crashes in the period 1997–2007 in this subregion.

Noise

It is estimated that approximately 30 per cent of the EU-15 population is exposed to levels of road traffic noise of more than 55 dB. World Health Organization (WHO) guidelines limit noise levels for residential areas to 55 dB during the day and to 45 db during the night. Exposure to high noise levels has decreased in some countries since 1980 due to technological measures, noise barriers, and adapted spatial planning. However, some of these achievements are likely to be offset by the expected growth in traffic.

In EECCA countries, noise pollution decreased in the 1990s due to reduced economic activity and transport volumes. With the economic recovery, noise levels are increasing due to strong industrial growth and the related increasing levels of transport activity. Older vehicle fleets and poor vehicle maintenance in EECCA and SEE also contribute to higher noise levels. It is estimated that about 38 million people in the Russian Federation are exposed to annoying transport-related noise. In Moscow, 60 to 80 per cent of the population lives in areas with transport-related noise above permissible levels.

In spite of efforts to reduce its harmful effects on urban population, transport-related noise levels are steadily increasing across Europe, with motor vehicles and aircrafts being the most important contributors.

Energy use

In Western Europe (EU-15 plus Norway and Switzerland), transport uses 30 per cent of total energy. Since the end of the 1990s, the overall energy consumption has been increasing across Europe. Transport energy consumption in the EEA-17 area has grown by about 2 per cent per year during the period 1990–2000, and has equaled some 35 per cent of all energy use in 2005. In 2003 in SEE, transport used about 26 per cent of the total energy, with road transport accounting for about 91 per cent of that energy use. In Western Europe, road transport (81%) has the lion's share of the total fuel use by the transport sector, followed by air transport (13%) and rail and water transport (2% each). Elsewhere, the industrial sector is relatively larger and oil is still used for electricity generation, so that the transport sector's share of 33 per cent of oil demand is somewhat lower.

On average, in EECCA countries transport consumes 17 per cent of total energy use, less than in Western Europe (35%) and Central and Eastern Europe (22%). In the Russian Federation, the transport sector uses about 19 per cent of total energy consumption and in Tajikistan about 28 per cent, the highest rate in the region. In most EECCA countries, road transport consumes more than 70 per cent of the energy consumed in transport sector. The highest share of energy consumption by the road sector is in Tajikistan with 98.4 per cent of the overall transport sector consumption, and the lowest is in the Russian Federation, with about 44 per cent.

Carbon dioxide emissions

As a consequence of the growing energy consumption, carbon dioxide (CO_2) emissions from transport sector have also continued to increase. Although some countries have made significant efforts to cut transport sector CO_2 emissions, overall emission levels have continued to increase steadily over the last 10 years.

According to the International Energy Agency, transport sector emissions grew by 1,412 million tons (31%) worldwide between 1990 and 2003, and increased 820 million tons (26%) in the Organisation for Economic Co-operation and Development (OECD) countries, accounting for 71 per cent of worldwide CO_2 emissions from transport.

In the EU, the transport sector's share of CO_2 emissions in 1994 was 26 per cent, and about 8 per cent in Central and Eastern Europe. During the period 1990–2000, transport's contribution to GHG emissions increased by 4 per cent in Central and Eastern Europe and by 19 per cent in the EU-15. Between 2003 and 2004, the increase of climate-changing GHG emissions from the transport sector, excluding international aviation and shipping, was 2.2 per cent.

In EECCA and SEE, total CO_2 emissions during the 1990s were estimated to be lower than in the rest of Europe, partly due to restructuring or closure of heavily polluting and energy-intensive industries as well as to the overall decline in economic and transport activities in this period. With the increase in economic activity and the growing transport demand, however, transport-related CO_2 emissions were expected to increase after 2000.

Progress made in the three priority areas: policy integration, urban transport and demand management

Policy integration

There have been significant developments in the integration of environment and health issues into transport policy in Western Europe in the last 10 years. Sustainable development became a fundamental objective of the EU when it was included in the Amsterdam Treaty[1] as an overarching objective of EU policies from 1997, and in 1999 when the Cardiff European Council defined its strategy on integration. This meant that sustainable development issues had to be integrated into EU policies, including those on transport. This issue has been sustained throughout the period 1997–2007 with a number of far-reaching integrating policies. Nevertheless, there are still challenges to be tackled regarding full policy integration in Western Europe.

Overall, policy reform and integration for sustainable transport in EECCA and SEE countries has been slow in the period 1997–2007. One reason for the limited progress is that the need for economic revival (especially in EECCA) in the period 2000–2007 eclipsed environmental goals. Other challenges hindering environmental and health performance and policy integration in the EECCA and SEE include: (a) fragmentation of the policymaking process; (b) the lack of appropriate environmental criteria, indicators and methodologies; and (c) the lack of concrete targets for implementation at the national, regional and local levels.

Sustainable urban transport

Often, institutionally separated and non-integrated transport, environment and health policies and urban land-use planning have led to unsustainable and unhealthy development in urban areas. The shift from public to private transport has led to a sprawl of new roads, streets and parking spaces in many parts of Europe, further increasing congestion and causing greater pollution and noise instead of improved mobility for the urban population.

In several cities in the UNECE-WHO European region, local and national authorities have devoted resources and targeted policies toward sustainability at the urban level, drawing on good practices and innovative transport solutions. Most people in the region live in cities, and most transport-related environmental and health problems occur in cities and their surroundings. Better understanding both of the complexities of the relationship between transport and its effects on health and environment and of the positive effects of bringing together various sectors together to develop regulatory instruments and multilateral environmental agreements have also played a role. One important instrument for reducing air emissions, including from transport, has been the UNECE Convention on Long-range Transboundary Air Pollution and its eight protocols. Under the Convention, each contracting party must develop effective policies, strategies and measures for air pollution abatement, including air quality monitoring, modeling and measurements.

A number of technical and legal measures implemented since 1990 – notably the ban of lead petrol, a decrease in the sulphur content of fuels, and emission standards for vehicles – have led to a reduction of some vehicle exhaust emissions in Western Europe. Perhaps the most significant is that since 1 January 2002, all petrol sold in the EU has been unleaded. In 2007, the European Commission proposed new standards for transport fuels which will further reduce their contribution to air pollution and climate change.

Across the EU, there has been positive progress on injury reduction. Better enforcement of speed limits, as well as alcohol limits, are among the most effective elements used to reduce fatality rates in spite of strong growth in transport demand.

Many countries in the region have observed trends towards separate places to live, work, and spend leisure

[1] *The Treaty of Amsterdam amending the Treaty of the European Union, the Treaties establishing the European Communities and certain related acts.*

time, favouring motorized mobility and contributing to decreased opportunities for cycling and walking. There is some indication that transport professionals are increasingly working with health professionals to improve conditions for walking and cycling and to help to make physical activity part of daily activities. Certain countries (Austria, Belgium, the Czech Republic, France, Germany, the Netherlands, Norway, Switzerland and the United Kingdom) have implemented effective cycling policies and others, including some SEE countries, have started to follow this lead. However, the potential for a more sizeable share of walking and cycling still remains largely untapped in many countries.

It is only relatively recently that road transport regulation has included a focus on noise, most notably through the EU Directive on Environmental Noise, adopted in 2002. The evidence of insufficient national noise emission standards, together with unsustainable trends in noise pollution, indicates gaps in the existing legislation. A holistic and integrated approach to reducing human exposure to noise is lacking at the international level.

Demand management and modal shift

There have been a number of developments aimed at managing or limiting the demand for transport in Western Europe. These include EU instruments such as the European Spatial Development Perspective, the EU Transport Strategy (1999), the European Commission Communication "Sustainable Urban Development in the EU: A Framework for Action" (1998) and the European Sustainable Cities and Towns Campaign. Despite these efforts, there is little evidence that transport demand has been curbed to a sustainable level which would correspond with the objectives of demand management and modal shift policies.

The EU White Paper on transport (2001) predicted that between 1990 and 2010 road transport would increase by 50 per cent, with forecasts indicating that this growth would apply to both the overall volume of transport and the intensity in terms of kilometres travelled and tons transported.

There was limited progress made during the period 1997–2007 with respect to transport-sector demand management in EECCA and SEE, particularly regarding implementation of measures to reduce the need to travel through land-use planning, policies and other measures.

The 2001 EU White Paper on transport pointed out that the existing transport price structures generally fail to reflect all the costs of infrastructure, congestion, environmental damage and accidents. The European Conference of Ministers of Transport (ECMT) stated in 2003 that a pricing and charging system which was clearly and fairly related to the value of infrastructure and external costs caused by its use was "many years" away. In most EECCA countries, the potential use of taxation to encourage environmentally less damaging behaviour is far from being fully exploited. In general, the use of economic instruments in EECCA countries to influence demand and modal shift is limited.

Conclusions

Trends over the past 10 years point to the need for innovative solutions that address the challenges of sustainability, accessibility, mobility and making cities more liveable. Meeting these needs requires a strengthened and sustained commitment from Governments at the national and local levels as well as a renewed political impetus for change.

There is likewise a great need to integrate the principles of sustainable development into transport policies. These include the system elements that best protect health, conserve resources, are energy efficient, consume the least land, have the lowest externalities, are socially acceptable and are the safest.

THE PEP is a unique policy framework that aims to encourage Governments to pursue more sustainable and healthy transport policies. For further information, consult THE PEP website (http://www.thepep.org/en/welcome.htm) or THE PEP Clearing House (http://www.thepep.org/en/workplan/clearing/ch.htm). Further examples of good practices in countries in the region as well as a number of recommendations and guidance for future action can be found in THE PEP Assessment Report (ECE/AC.21/SC/2008/3 - EUR/08/5068055/3).

1 - Introduction

Transportation is an integral part of economic and social development and is essential to the functioning of modern societies. It enables people's access to services and goods and offers possibilities for trade, living, leisure and learning. However, current transport patterns are increasingly dominated by motorized road transport, which has more adverse impacts on health and the environment than rail and shipping and is substantially less sustainable than walking and cycling, important alternatives especially in urban settings. Today's transport patterns have negative consequences not only on environment and health, but also on the transport system itself, e.g. by increasing congestion in urban areas, and are therefore not sustainable. To a large extent, the difficulty of achieving progress towards sustainability is attributable to the fact that technological improvements have been offset by the growth of transport, particularly in the countries with economies in transition. An important driver of transport patterns, transport costs do not reflect full economic and social costs, thus perpetuating the unsustainable growth of transport and its negative impacts.

In short, current patterns of transport and travel in the countries comprised in the region of the UNECE/WHO European region require innovative solutions aimed at long-term sustainable development, in particular in urban areas. This requires a stronger commitment from Governments at the national and local levels and a renewed political impetus for change. Cooperative approaches to sustainable urban transport mean that transport policymakers must increasingly consider the impacts on both health and the environment. Intersectoral cooperation between transport, health and environment is a key component of THE PEP policy platform, which aims to provide an international framework for implementation at the national and local levels. The challenge is to develop institutional arrangements and encourage the necessary commitment by Governments to adopt an intersectoral approach to policymaking. This attitudinal shift and shift in practice is critical in meeting the challenge of reducing the negative consequences of today's transport patterns on the environment and the health of populations, while at the same time preserving their social and economic benefits.

1.1 The Transport, Health, and Environment Pan-European Programme

At the 1997 Vienna UNECE Regional Conference on Transport and the Environment, ministers agreed to work towards the integration of environment and transport policies at the local, national, and international levels, committing themselves to reducing the negative impacts of transport on the environment and human health by promoting (UNECE 1997):

- Measures to reach volumes and patterns of transport that are compatible with sustainable development
- Energy-efficient and less polluting vehicles and fuel
- Efficient and sustainable transport systems
- Protection of sensitive areas
- Sustainable urban transport
- Safe transport of dangerous goods
- The prevention of water pollution
- A programme of joint action
- Future cooperation.

At the 1999 WHO Ministerial Conference on Environment and Health in London (WHO Europe 1999), the European Charter on Transport and Health was endorsed, which highlighted the need to involve health authorities in decision-making on transport, land use, and infrastructure policies. The 2002 Second High-level Meeting on Transport, Environment, and Health, the Vienna and London initiatives were merged into the Transport, Health and Environment Pan-European Programme (THE PEP). The agreed policy framework of THE PEP focuses on three priority areas and related actions, and two cross-cutting issues.

The three priority areas and related actions (UNECE and WHO Europe 2007) are:

- The integration of environmental and health aspects into transport policy, in particular in relation to decision making processes, monitoring and impact assessment.
- Sustainable urban transport, involving measures in land-use planning for promoting high-quality and integrated public transport and for improving safe conditions of alternative modes of transport.
- Demand side management and modal shift.
- The two cross-cutting themes are:
- The needs of the countries in EECCA and SEE
- Ecologically sensitive areas.

Since its inception, THE PEP has targeted these priority areas with innovative programmes and activities at the urban and local levels and has aimed to stimulate policy coordination at the national level between the three sectors. An assessment of achievements of THE PEP and the programme's future challenges can be found in a separate report (ECE/AC.21/SC/2008/3).

1.2 Objectives, methodology, and limitations of this review

This report reviews developments and highlights progress made between 1997 and 2007. It describes relevant transport trends, analyses the environmental and health effects of transport and summarizes the progress with regard to the policy and regulatory response to these effects in Western Europe, EECCA and SEE in efforts to achieve sustainable transport. It will thereby serve as one of the main background documents to the Third High-level Meeting on Transport, Health and Environment in 2009 and provide background statistics and information to support the political declaration expected to be adopted by ministers during the meeting.

A review of progress made in the three priorities of THE PEP (integration of environment and health into transport policies, sustainable urban transport and demand-side management and modal shift) as well as on cross-cutting issues (ecologically sensitive areas and the particular needs of EECCA and SEE countries) from the point of view of THE PEP programme and the participating member States, together with recommended actions and the way forward, are described in a separate background document, THE PEP Assessment Report.

THE PEP Assessment Report summarizes available data from reports and databases published internationally.

Major information sources include the European Conference of Ministers of Transport (ECMT) and UNECE statistics and Organisation for Economic Co-operation and Development (OECD) reports on transport and road safety, as well as the Health-for-All database and publications of the WHO Regional Office for Europe (WHO Europe). Also related, indicator systems were used, most notably the Transport and Environment Reporting Mechanism (TERM) of the European Environment Agency (EEA) and the Environment and Health Information System (ENHIS) of WHO Europe. Additional information was obtained from THE PEP Clearing House[2] and from reports of workshops and materials prepared for the the Sixth Ministerial Conference "Environment for Europe" (Belgrade, 10–12 October 2007). Altough an effort has been made to provide the most recent available statistics, data often date back to 2004-2005. In addition, data on some of the issues addressed and on some countries were scarce. Furthermore, it was not always possible to obtain data for the full period 1997–2007. Therefore, occasionally, other time periods, such as 1990–2000 or 2003, needed to be used.

1.3 Structure of the report

Chapter 2 introduces the countries of EECCA, SEE and Western Europe; it also provides a brief overview of the main transport trends in the whole region. Chapter 3 describes and analyses the principal environmental and health effects of transport. Chapter 4 focuses on the progress achieved since 1997 in the three priority areas of THE PEP, with a special focus on the progress made in EECCA and SEE countries.

[2] *http://www.thepep.org/CHWebsite/.*

2 - Trends and Developments in Transport across the UNECE-WHO European Region

2.1 Introduction to the Study Area

2.1.1 UNECE-WHO European region

The UNECE/WHO Europe region covers 56 member States[3] stretching from Ireland in the west to the Central Asian States in the east. This region contains great diversity in terms of geography, economy, culture, and language and per capita , particularly between the countries of Western Europe and those from EECCA and SEE (defined below). In addition to providing an overview of developments and trends across the entire region, this report aims to illuminate issues specific to Western Europe and to EECCA and SEE countries.

There have been a number of important developments in the region between 1997 and 2007, the most notable being the enlargement of the EU from 15 to 27 countries, with the accession of 10 countries on 1 May 2004 and 2 countries on 1 January 2007, as well as the emergence of new Member States.

The Western European economies have experienced relatively weak growth during this period, with growth rates half that of the United States (ECMT 2007). Western Europe's economic performance was the poorest of all of the world's economic regions. Over the five-year period from 2001 to 2005, the economy of the Euro area grew by barely 8 per cent, trailing almost 5 percentage points behind the United States and 13 behind the rest of the world. Annex I shows the main statistical indicators for each country in the EU-27. By contrast, economic growth in the EECCA subregion has accelerated dramatically since the late 1990s, led by the strong performance of the Russian Federation. EECCA has become one of the world's fastest growing areas, its aggregate GDP having expanded rapidly up to 2007.

2.1.2 EECCA and SEE countries

For the purposes of this report, EECCA includes 12 countries: Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, the Republic of Moldova, the Russian Federation, Tajikistan, Turkmenistan, Ukraine and Uzbekistan. SEE includes six countries: Albania, Bosnia and Herzegovina, Croatia, Montenegro, Serbia and the Former Yugoslav Republic of Macedonia. Some definitions of SEE also include Bulgaria, Romania and Turkey.

As noted above, EECCA and SEE are heterogeneous subregions, including countries with diverse historical, geographic, political, and economic profiles as well as endowments of natural resources. Differences in per capita income are considerable. While agriculture plays an important role in some economies (e.g. Albania and the Republic of Moldova), the industrial sector is strong in others (e.g. Belarus, the Russian Federation and Ukraine); for some, the extraction of oil and gas is highly important (e.g. Azerbaijan, Kazakhstan and the Russian Federation). Pollution issues tend to be more important in the urbanized, industrial countries, whereas natural resource management issues tend to dominate in the Urals, Siberia and Central Asia.

EECCA and SEE countries also differ in response capacity. (For instance, 7 of the 12 EECCA countries are International Development Association (IDA) countries[4], where it can be assumed that domestic funds for environmental improvements are scarce.) Unemployment remains high in a number of countries, especially in SEE. Map 1 shows EECCA and SEE, and annex II highlights some of these differences, including land area, population, density, degree of urbanization, economic structure, GDP per capita (2005) and GDP growth rate (2005).

[3] *UNECE also includes Canada, Liechtenstein and United States of America, which are not included in the report.*

[4] *According to the World Bank lending categories, Armenia, Georgia, Kyrgyzstan, the Republic of Moldova and Tajikistan are IDA countries. Azerbaijan and Uzbekistan are a blend of IDA/IBRD (International Bank for Reconstruction and Development) countries. Belarus, Kazakhstan, the Russian Federation, Turkmenistan and Ukraine are IBRD countries (OECD 2007).*

Map: United Nations Economic Commission for Europe

Source: Map No. 3976, Revision 11, Department of Field Support, Cartographic Section, United Nations, May 2008

2.2 General transport trends

The integration of European economies and societies during the period 1997–2007 has been accompanied by significant economic and social development. Transport, particularly international freight and passenger transport, has increased steadily in recent decades and has made a considerable contribution to economic growth. The improved efficiency and quality of transport services in an increasingly liberalized and competitive market environment have opened up new markets by considerably reducing the costs and the risks for traded goods. The transport industry now constitutes one of the most important economic sectors, accounting for close to 10 per cent of the GDP and employment in Europe (United Nations Economic and Social Council 2001).

Table 1 provides an overview of the length of roads, motorways, railways, and waterways for EU-25, SEE and EECCA as of 2003. It should be noted that the group total shows an increase in roads and motorways and a decrease in the length of railways and waterways, reflecting the continuing trend towards road transport growth in place of more environmentally friendly rail and waterway transport.

2.2.1 Overview for Western Europe

As shown in table 1 below, there has been extensive building of new roads in SEE and new motorways in SEE and EECCA as the countries in the two subregions shift their focus to road transport. Total road and motorway length has increased in EU-15 and EU-25 countries, but at a lower rate than in SEE and some EECCA countries. Both railroads and inland waterways have declined.

In the EU, passenger and freight transport have more than doubled over the past 25 years, reflecting the general trend towards increased mobility, as well as general economic development in the region. The pace of this growth generally follows that of GDP (United Nations Economic and Social Council 2001), although relative decoupling of growth in freight volumes from economic growth has been achieved in the EU-10, where the growth in GDP exceeds

Table 1: Length of roads, motorways, railways and waterways in EU-25, SEE and EECCA, and changes for 1990–2003

	Length of roads (in 1000 km)			Length of motorways (in km)			Length of railways (in km)			Length of waterways (in km)		
	1990	2003	change (%)	1990	2003	change (%)	1990	2003	Change (%)	1990	2003	change (%)
EU-15	3,520	3,888	10	39,620	54,081	36	159,834	150,864	-5	28,913	29,330	1
EU-10 new	764	925	21	1,732	3,038	75	53,737	47,837	-10	8,973	6,529	-27
EU-25 TOTAL	4,284	4,813	12	41,352	57,119	38	213,571	198,701	-7	37,886	35,859	-5
Other Western European countries*	171	175	2	1,543	1,957	27	7,026	9,236	31	21	-	-
SEE**	291	590	102	1,415	3,463	144	32,793	33,035	1	3,185	4,462	40
EECCA***	815	969	18	1,647	4,236	157	142,201	139,415	-2	111,794	107,873	-3
Group total	**5,390**	**6,372**	**18**	**44,414**	**64,818**	**45.94**	**388,565**	**371,151**	**-4**	**152,865**	**148,194**	**-3.06**

Source: UNECE 2006a and own calculations

Notes: * Andorra, Iceland, Liechtenstein, Monaco, Norway, San Marino, Switzerland.
** Includes Bulgaria, Romania and Turkey .
*** Without Kyrgyzstan, Tajikistan and Turkmenistan.

the high growth in transport volume (Term 2005). The EU Trans-European Network (TREN) has been one of the main driving forces in the integration and development of international transport corridors.

Figure 1 shows that the volumes of passenger transport relative to GDP have declined since 1995 in the EU-15, implying some decoupling of growth. This does not appear to be the case in the European Free Trade Association (EFTA) countries[5]), where the volume relative to GDP has increased slightly since 1995.

The number of passenger km travelled by private car has increased steeply in recent decades, while those travelled by public transport increased far less and those by bicycle and on foot have remained largely stable, having been at historically low levels since the early 1970s (European Commission 2002). On average, people in Western Europe spend almost 1 hour travelling every day (European Commission 2000). They cycle about 0.5 km and walk about 1 km, while travelling 27.5 km by car. Cycling accounts for a more sizable share of daily mobility only in a few countries, e.g. Denmark and the Netherlands.

2.2.2 Overview for EECCA and SEE countries

Trends currently indicate that for a number of reasons, road transport is getting more important in the EECCA and SEE countries, and also that road transport volumes and the number of road vehicles will increase in the next decades. While it is highly likely that rates of walking and cycling are declining in EECCA and SEE at the expense of travel by car, data are not available on the trends for walking and cycling in EECCA and SEE to compare with Western Europe. (Trends in public transport are examined in section 2.4.)

[5] *Iceland, Liechtenstein, Norway and Switzerland.*

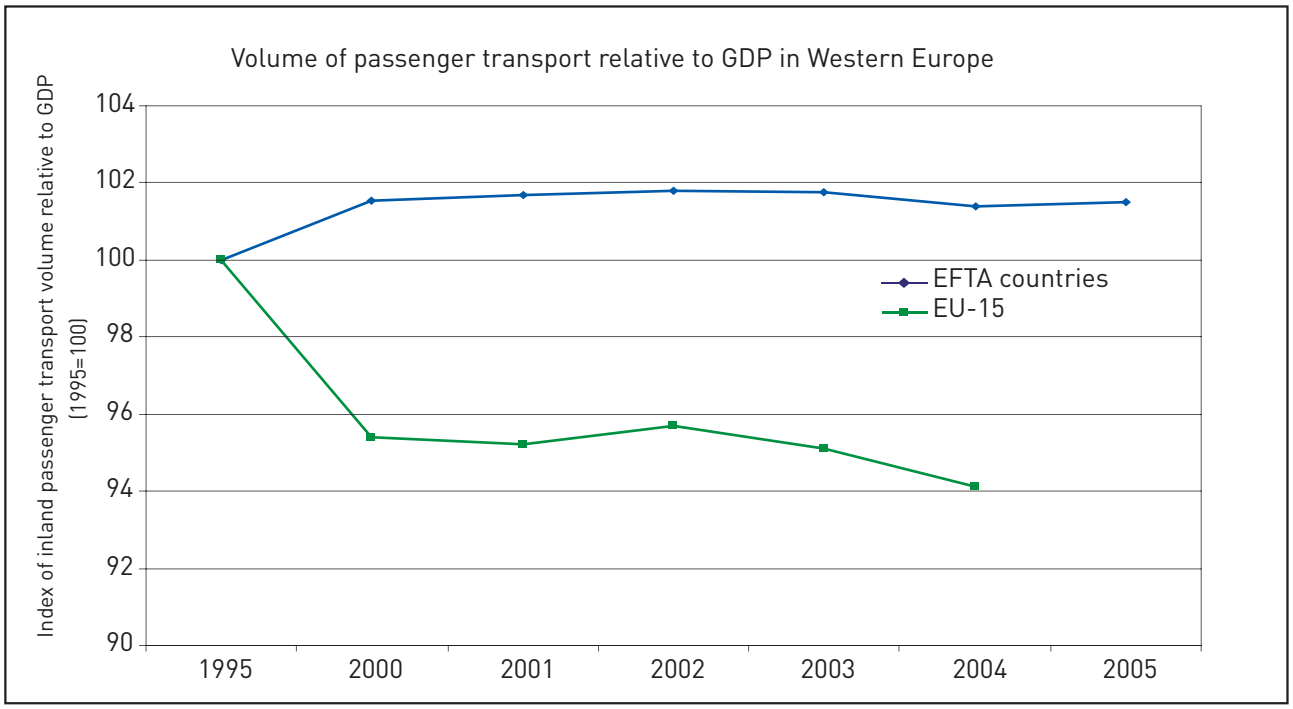
There has been a great deal of investment in transport infrastructure in EECCA in recent years. European Bank for Reconstruction and Development (EBRD) transport loans to the EECCA region have mostly financed roads in recent years, in contrast with the period before 2000. In general, the international financial institutions have focused on road transport projects (BRRT 2007c). In the period 1990–2003, the length of motorways increased significantly in EECCA and SEE (see table 1). The length of other roads, railways, and (navigable) waterways decreased in EECCA, while the latter have all increased in SEE. In addition to showing a shift away from investing in rail and waterway transport in EECCA, this probably also highlights the issue of maintenance: some EECCA transportation assets continue to suffer from decade-long neglect and under-investment.

Also in SEE, a modal shift away from rail can be observed, which is partly related to technical issues. On the one hand, technical standards often differ from one country to the next, making the system not fully interoperable. Other reasons include a lack of continued investment in rail and of the effective restructuring of rail monopolies.

The capacity of inland shipping for goods transport is largely unutilized, partly due to lack of appropriate infrastructure (missing links, i.e. connecting links that would help complete a network represent about 5 per cent of the Pan-European network) and the existence of different rules, regulations, and practices in inland navigation between countries and regional markets (e.g. the Rhine, Danube, and Volga). To make the rail and inland shipping sector more competitive vis-à-vis roads, the rail and shipping technology, infrastructure, and regulatory framework would need to be modernized and harmonized.

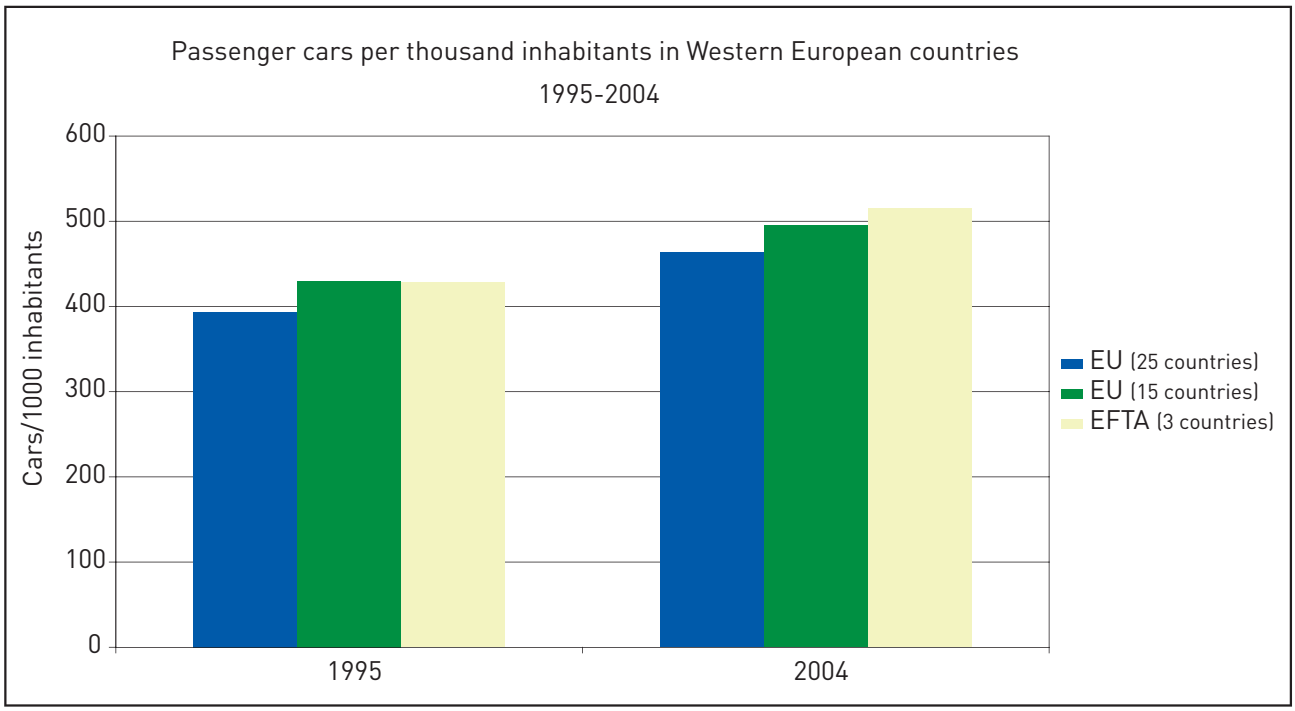
Overall, the transport infrastructure in EECCA and SEE (and in particular, the road infrastructure) is deemed insufficient. Availability of funds to address transport capacity needs in the two subregions represents an important challenge as

Figure 1: Volume of passenger transport relative to GDP in the EU-15 and EFTA countries



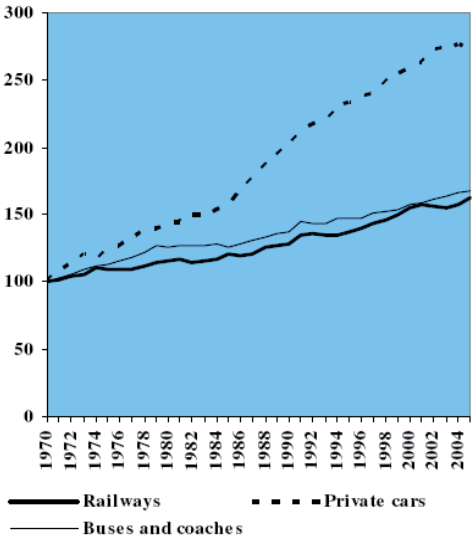
Sources: Eurostat indicators (EC 2007c), International Transport Forum (2008)

Figure 2: Passenger cars per thousand inhabitants in Western European countries, 1995–2004



Source: Eurostat indicators (EC 2007c) ; International Transport Forum (2008)

Figure 3: Trends in passenger transportin Western Europe (in p-km; 1970 = 100)



Source: ECMT

the estimated financial outlay to improve these transport networks was estimated at 2 to 2.5 per cent of the GDP over many years (UNECE 2006b).

2.3 Passenger transport

2.3.1 Introduction to passenger transport

In general, people tend to spend a fixed share of their income on transport, so increasing income is a major driver of growth in passenger transport. Spatial development is also an important determinant for transport volumes. For example, the construction of out-of-town shopping malls creates transport demand among car-dependent shoppers. These trends partially account for the increase in passenger transport in recent years, and lead to predictions that there will be strong pressure on growth in transport volumes in the next decade (EEA 2007b).

2.3.2 Passenger transport in Western Europe

Between 1990 and 2003, passenger transport volumes in the EEA member countries rose by 20 per cent, while GDP increased by 30 per cent. Thus, in contrast to freight transport, passenger transport has on average grown more slowly than the economy since the mid-1990s. Over the period 1995–2003, the economy grew slightly faster than passenger transport volumes (EEA 2007b). Air transport grew the most during this period (+96%), followed by private car transport.

On average, each citizen from Western Europe travels in total about 12,044 km annually. Passenger cars accounted for 80.6 per cent of this total, powered two-wheelers for 2.6 per cent, buses and coaches for 9.1 per cent, railways for 6.4 per cent and tram and metro for 1.4 per cent. (Eurostat 2004).

Figure 3 shows that travel by private car in Western Europe appears to have continued to rise dramatically since the mid-1990s. In addition to increasing distance travelled, data show that average occupancy rates for passenger cars are lower than a decade ago. This can be accounted for by growing car ownership, the decreasing average size of households and dispersed spatial patterns (EEA 2006).

2.3.3 Passenger transport in EECCA and SEE

2.3.3.1 Passenger transport by rail and by coach and bus in EECCA and SEE

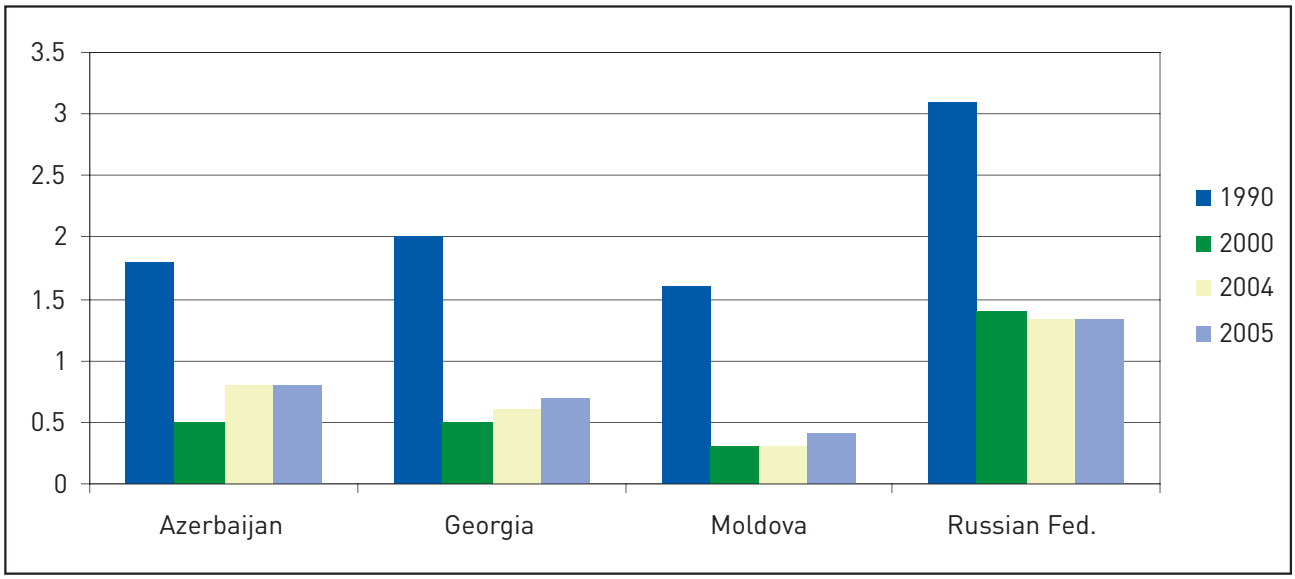
Based on the available data, passenger transport demand declined in EECCA and SEE in the 1990s due to the economic restructuring and lower GDP, affecting all modes of passenger transport. Since 2000, rail passenger transport in EECCA countries is slowly growing (see figure 4), whereas SEE countries generally show a stagnation (e.g. Croatia) or a decrease in the number rail passengers (e.g. Montenegro and Serbia).

The available data indicate that passenger transport by coach and bus in SEE has been generally stable or slightly increasing since 2000, although numbers are still far from the 1990 level. EECCA shows passenger transport by coach and bus showing an overall decline (e.g. decreasing by 25 per cent in the Russian Federation between 2004 and 2005, but increasing in some countries between 2000 and 2004, for instance in Azerbaijan, the Republic of Moldova and Ukraine).

2.3.3.2 Trends in the delivery of public transport relevant to EECCA and SEE countries

Eijbergen (2004) described the Russian Federation's urban public transport system (which can serve as the key example for EECCA, and to some extent, SEE). Public transport retains a 85 to 90 per cent share of passenger transport in the Russian Federation's urban areas (as compared to 20% in Western Europe and 3% in the United States). However, the public transport fleet is deteriorating due to several reasons, including a high percentage of exempted passengers, low fares and poor collection of fares, as well as a significant decrease in federal funding and transfer of responsibilities to local authorities. This situation somewhat improved in 2005, after fare exemptions for a significant share of passengers were replaced by monthly payments from the federal budget. In addition, street networks are deteriorating, mainly due to inadequate municipal funding for road maintenance and rehabilitation. The public transit subsidy (although considered high by international

Figure 4: Rail passenger transport in selected EECCA countries (in billion p-km)



Source: BRRT 2007c; ECMT 2007; UNECE 2007 and the official statistics of the Russian Federation

standards) only covers about two thirds of what is needed for urban transport operations (the subsidies do not cover capital replacements).

With the decline in public passenger services, private operators (especially of minibuses) have emerged in many cities. This has increased the level of service, but has also resulted in other problems, including a large number of small vehicles with questionable safety features, erratic and unsafe driving practices and a disregard for the needs of exempted passengers (ECMT 2005a). The conclusion is that, in the absence of supportive policies and investments (including better regulatory frameworks and performance-based incentives), urban public passenger transport will continue to deteriorate and may fail to maintain or regain its competitiveness.

2.3.3.3 Passenger cars (including taxis), passenger cars per 1,000 persons and the age of the vehicle fleet in EECCA and SEE

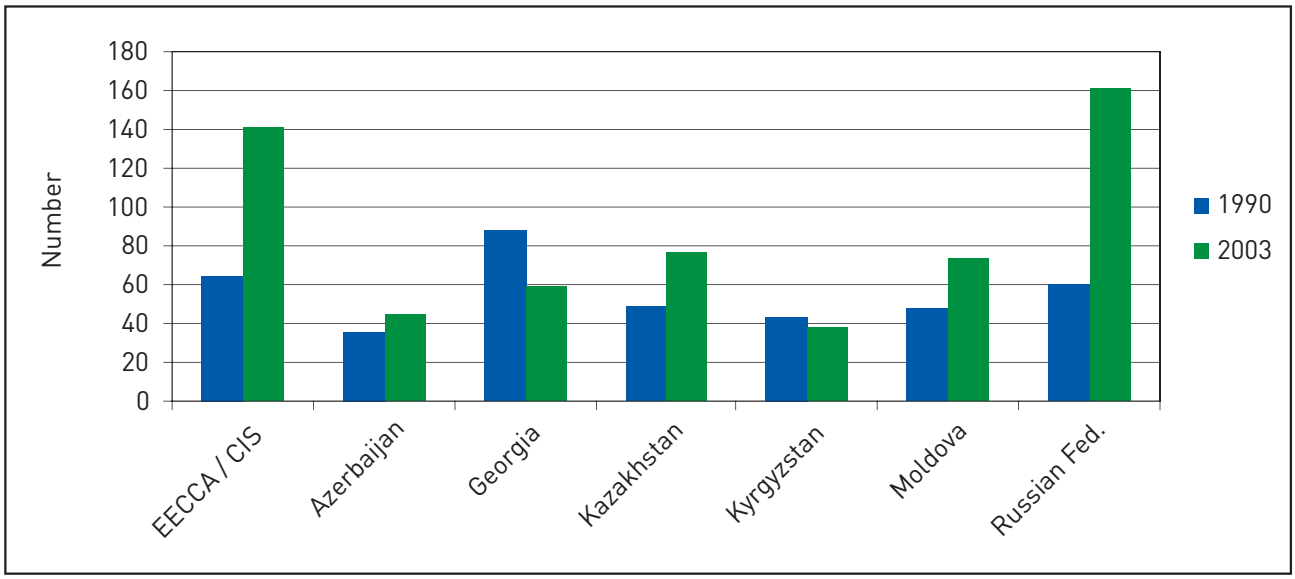
On the average, the share of passenger car transport is still very limited in EECCA (although it is booming in the capitals and major business centres). Passenger car transport in SEE generally experienced strong growth from 1990 to 2003, at the expense of passenger rail transport. This reflects increased income and a preference for private car transport. Notably, Albania and Croatia experienced a significant increase in passenger cars (from 58,682 to 174,782 and from 710,910 to 1,282,000 passenger cars, respectively). The former Yugoslav Republic of Macedonia saw a slight increase (from 285,907 to 300,000), whereas Serbia and Montenegro showed a 12.3 per cent decrease (from 1.6 million in 1995 to 1.4 million in 2003) in this time period. Albania saw an increase from 18 passenger cars per 1,000 persons in 1994 to 48 in 2002, Croatia an increase from 143 to 276. The number of p-km travelled by private car has been increasing steadily since 1987 in Central and Eastern Europe (CEE), with a further jump of about 8 per cent in 2005 (compared to 2004) (ECMT 2007).

Among the EECCA countries, the Russian Federation's passenger cars increased the most (from 14.2 million in 1995 to 29.4 million in 2007 or +107% increase). During the period 1990–1999, the motor vehicle fleet in the Russian Federation increased at an average annual rate of 7.6 per cent (in 2007 9%), with most of the increase occurring in urban areas. The number of passenger cars also increased in the Republic of Moldova (from 166 to 266 thousand, or +60%), Azerbaijan (from 278,000 to 370,000, or +33%), and Kazakhstan (from 1.03 to 1.150 million, or +11%). In contrast, Georgia and Kyrgyzstan showed a decrease in the number of passenger cars in the period 1995–2003 (from 361,000 to 255,000, or -29.2%, and from 198,000 to 189,000, or -4.4%, respectively).

EECCA went from 64 passenger cars per 1,000 persons in 1990 to 141 in 2003. In 2003, the number of passenger cars per 1,000 persons ranged from 38 in Kyrgyzstan to 161 cars per 1,000 inhabitants in the Russian Federation, which showed the most significant increase, from 60 in 1990 to 161 in 2003 (see figure 5) and to 207 in 2006. [In Moscow, the private car fleet has increased on average by 7.3 per cent annually, reaching 268 cars per 1,000 persons in 2006 (NIIAT 2007)]. EECCA residents currently travel only 800 km per capita by car (half the 1993 number); people in Western Europe travel more than 12,000 km per capita by car.

However, the levels of private car ownership in EECCA and SEE, below 180 cars per thousand of the population in all EECCA countries and below 290 in SEE, are still much

Figure 5: Passenger cars per 1,000 persons in selected EECCA countries



Source: UNECE 2006a and UNECE 2007

lower than the typical values of 400 to 600 in Western Europe (UNECE.2006a).

In general, EECCA and SEE countries have comparatively old vehicle fleets. For instance, in 2000 50 per cent of the vehicles in the former Yugoslav Republic of Macedonia were more than 20 years old, and the maintenance standard was low. OECD (2007) indicated that 90 per cent of the cars in Armenia and 86 per cent of cars in Belarus are more than 10 years old. In Kyrgyzstan, 92 per cent of all vehicles were older than 10 years, and the situation was similar in Uzbekistan (90%), Georgia (88.6%), the Republic of Moldova (78.1%) and Azerbaijan (77%). In the Russian Federation, the age structure of the vehicle fleet has been steadily improving since 2002, with 62.5 per cent of the fleet being older than 10 years in 2007 (NIIAT 2007). There are no clear indications as to whether the vehicle fleet is getting older on average.

2.3.4 Cycling and walking

The transport sector has considerable potential to enhance health by offering opportunities for physical activity through walking and cycling. Physical activity has major beneficial effects on several chronic diseases, notably coronary heart disease, diabetes and some cancers. To enhance health, at least half an hour of moderately intense physical activity per day for adults and 1 hour per day for children are recommended (WHO 2004b); this can be achieved by walking and cycling. Therefore, transport-related cycling and walking have great potential to improve health by boosting average physical activity levels.

Cities with strong pro-cycling policies have shown that cycling for transport can significantly increase overall activity. Overall trends in physical activity – including activity carried out as sport, recreation, work and leisure as well as transport – across the European region are unclear due to an uneven availability of data on levels of physical activity and the lack of harmonized measures and indicators.

There is also a lack of data across Europe on trends in walking and cycling in recent years. Data from some countries indicate that overall levels of physical activity have remained stable, while data from other countries show that transport-related walking and cycling in particular have declined (Cavill et al 2007).

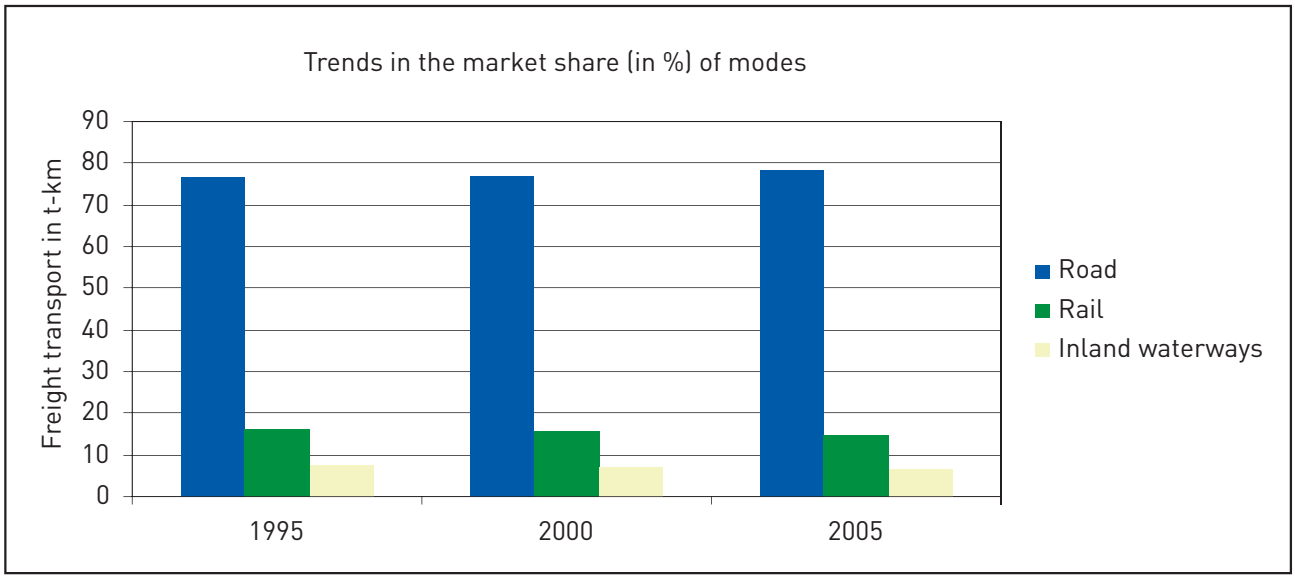
WHO estimated that 20 to 25 per cent of the EECCA population is physically inactive (versus 17% in the EUR A[6] countries). About 8 to 10 per cent of the mortality in EUR B and C[7] is attributable to physical inactivity (WHO 2002, quoted in Dimitrov 2004). The contribution of walking and cycling to overall levels of physical activity in EECCA and SEE is unclear, but it is likely that as the modal shift towards car travel continues, levels of walking and cycling will decline.

WHO estimates that lack of physical activity causes about 10 to 16 per cent of the cases of breast, colon and rectal cancers as well as diabetes mellitus, and about 22 per cent of ischaemic heart disease. About 5 to 10 per cent of the

[6] *EUR A: Subregion comprised of countries with very low adult mortality and very low child mortality: Andorra, Austria, Belgium, Croatia, the Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Israel, Italy, Luxembourg, Malta, Monaco, the Netherlands, Norway, Portugal, San Marino, Slovakia, Spain, Sweden, Switzerland and the United Kingdom of Great Britain and Northern Ireland.*

[7] *EUR B: Subregion comprised of countries with low child mortality and low adult mortality: Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, Bulgaria, Georgia, Kyrgyzstan, Montenegro, Poland, Romania, Serbia, Slovakia, Tajikistan, the former Yugoslav Republic of Macedonia, Turkey, Turkmenistan and Uzbekistan.*
EUR C: Subregion comprised of countries with low child mortality and high adult mortality: Belarus, Estonia, Hungary, Kazakhstan, Latvia, Lithuania, the Republic of Moldova, the Russian Federation and Ukraine.

Figure 6: Freight transport in Western European countries



Source: ECMT 2007

total mortality in European countries can be attributed to insufficient physical activity (WHO 2002). This translates into about 600,000 deaths and a loss of 5.3 million years of healthy life due to premature mortality and disability per year in the European region alone. The prevalence of insufficient physical activity among adults as well as children is estimated to be at about two thirds, with large differences between countries (Cavill et al 2006).

2.4 Freight transport

2.4.1 Introduction to freight transport

Freight transport is an important aspect of the overall transport system, especially in growing economies. Growing incomes enable people to consume more, which in turn increases transport demand and allows for changes to the logistics of production and distribution (e.g. "just-in-time" strategies). Distances between consumers and producers lengthen, facilitated by the removal of barriers to trade in the internal market and in the wider world (EEA 2007b). In much of Europe, it appears the volume of freight transport is growing faster than GDP, while passenger transport is growing at the same pace or slower than GDP. With more goods being transported over longer distances and more frequently, CO_2 emissions are increasing and the recent progress made in terms of decreasing air pollutant emissions is starting to slow (EEA 2006). The balance of types of freight makes a significant difference to potential impacts on health, as transport of freight by road tends to be associated with higher levels of harmful emissions and casualties than that by rail or water transport.

2.4.2 Freight transport in Western Europe

Road freight transport has continued to dominate the market in Western European countries, accounting in 2005 for 78.5 per cent of the combined ton-km carried by rail, road, and inland waterways (see figure 6). This reflects the cost and flexibility advantages of road transport as compared to other modes. In addition, road networks have developed much faster than rail networks (EEA 2007b).

Table 2: EECCA freight (all modes), 1991-2006

	Billion ton-km carried					Percentage carried by mode				
	1991	**1998**	**2004**	**2005**	**2006**	**1991**	**1998**	**2004**	**2005**	**2006**
Rail	3324	1344	2257	2336	2472	75.0	81.6	89.6	89.1	89.2
Road	121	50	110	144	165	3.0	3.0	4.3	5.5	5.9
Inland water	212	72	90	87	77	5.0	4.4	3.6	3.3	2.8
Sea	774	181	63	55.6	56	17.0	11.0	2.5	2.1	2.0
Total	**4,430**	**1,647**	**2,520**	**2,622**	**2770**					

Source: CIS Statistical Committee (date unknown)

2.4.2.1 Freight transport by road in Western Europe

Road freight has continued to grow slightly in Western Europe during the period 1997–2007, despite the virtually flat industrial activity. The amount of goods transported reached a record high in 2005 (see figure 6).

A closer look at the trends over time shows that road freight has been steadily capturing market share from rail and inland waterway transport. The progress made on European integration, and the resultant expansion of international trade, appears to have benefited road haulage undertakings directly (ECMT 2007).

2.4.2.2 Freight transport by rail in Western Europe

Compared with the road haulage sector, the share of rail in freight transport in Western European countries as a whole has been declining over the last decade. However, it should be noted that trends in growth varied substantially from one country to another, with a number of countries actually reporting a decrease. It appears that the rail sector's performance measured by ton-km has stagnated since the early 1990s, despite continued economic growth.

2.4.3 *Freight transport in EECCA and SEE Countries*

The available data up to 2004 show freight volumes in EECCA slowly recuperating from their low mid-1990s level. In contrast to Western Europe, in EECCA rail is still the most important means of freight transport (about 90% in 2004), whereas the other modes (road, inland shipping, and sea) currently have a limited role (see table 2). Inland water and sea freight show a small and continuously decreasing market share, whereas road freight is increasing, supported by the dynamic expansion of foreign trade in EECCA. Although road freight still represents a small share of total freight transport, it is expanding considerably, doubling from 1998 to 2004 (i.e. from 50 to 110 billion ton-km) (CIS Statistical Committee, date unknown).

In SEE, road and rail transport account for most freight movements, with some inland shipping on the Danube River. Although table 3 below includes all CEE countries and the Baltic States, it conveys well the general trends in the SEE region: the market share of rail and inland water transport is decreasing, while the market share of roads is increasing. The marked growth in the road transport sector is thought to be associated with the strong growth in exports to the EU and the Commonwealth of Independent States (CIS), especially since the mid-1990s (ECMT 2007). There are, however, different trends in the SEE countries, with some (e.g. Albania, Croatia and the former Yugoslav Republic of Macedonia) transporting more goods by road in 2005 than in 1990, while others (e.g. Montenegro and Serbia) are at about 10 per cent of their 1990 levels.

Table 3: Freight transport trends in the market share of modes in Central and Eastern European countries and the Baltic States (percentage)

	1980	1985	1990	1995	2000	2005
Rail	70.6	71.5	66.1	50.8	44.9	35.6
Road	26.1	25.4	30.5	46.6	52.7	61.5
Inland waters	3.3	3.1	3.4	2.6	2.4	3.0
	100	**100**	**100**	**100**	**100**	**100**

Source: ECMT 2007

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3 - Trends and Developments Regarding Effects of Transport on Health and the Environment

3.1 Introduction

The primary function of transport is the movement of goods and people between places, enabling access to people, social activities and leisure, and goods and services (BMA 1997). Many aspects of transport are thus health-promoting: they enable people to access services, to benefit their health through walking or cycling, or to access employment and contribute to general economic development. However, transport also has negative influences on health and the environment, notably through air pollution, road traffic injuries, traffic noise, psychological and social impacts, land use and possibilities for physical activity (WHO 1999). In recent years, policy has also focused on the role of transport on climate change (UNECE/WHO Europe 2004). This chapter briefly describes the impacts on health, with statistics and trends. (Chapter 4 reviews policy developments and progress over the last 10 years.)

3.2 Transport-related air pollution and its effects

Air pollution costs are estimated at 2 per cent of GDP in high-income countries. It reduces life expectancy, causes premature deaths, increases the use of medication and restricts employment by millions of days every year. The transport sector contributes about 25 per cent of the air pollution load, most of it from vehicles. Living along busy urban streets is associated with several diseases (e.g. exacerbation of asthma, chronic respiratory symptoms, allergic symptoms and reduced lung function) (WHO 2005 and UNECE/WHO Europe 2004).

Ozone, airborne particulate matter (PM) and lead are the transport-related pollutants that pose the most concerns, but SO_2, NOx, CO, lead scavengers and various carcinogens are also notable. Annex III provides a summary of the health effects and environmental effects of transport-related pollutants.

In addition to direct health impacts, air pollution also has indirect effects such as increased health expenditures (i.e. hospital admissions and costs of medication), as well as reduced fiscal receipts from reduced working time, which impact public finance expenditures and revenues (OECD 2007).

3.2.1 *Air pollution effects from transport in Western Europe*

It is estimated that life expectancy is shortened by an average of 8.6 months by air pollution in the EU countries. This is comparable to the number of fatalities from road traffic crashes and affects all age groups, including children. Non-fatal health effects include hospital admissions, use of medication, millions of lost working days, and negative impacts on the healthy development of children. While these non-fatal impacts are more difficult to quantify, they probably add substantially to the total burden of pollution-related ill health, especially in children (Krzyzanowski et al 2005).

An international study conducted in the framework of THE PEP has estimated that road transport-related air pollution in three European countries (Austria, France and Switzerland) causes 22,000 deaths in people over 30 years of age (Künzli et al 2000).

Recently, the CAFE[8] programme has put the number of life years lost due to exposure to air pollution (to fine PM such as PM2.5) in the EU-25) at close to 350,000 for the year 2000 (WHO Europe 2005). Geographically, CAFE studies suggest that the greatest damage to health occurs in the Benelux area, northern Italy and in parts of Poland and Hungary. In these areas, the average loss of life expectancy from air pollution exceed one year (see section 4.2 for trends and progress in air quality).

A recent publication from the European Environment and Health Information System (ENHIS 2007) has summarized data on levels of exposure of children to air pollution (PM) in urban outdoor air. They found country average PM10 exposure levels varied from 13 to 14 µg/m^3 (Finland, Ireland) to 53 to 56 µg/m^3 (Bulgaria, Romania and Serbia and Montenegro (Serbia)). There was a three-fold variation in the level of exposure of children to PM10 in cities of some countries.

The report also summarized changes from 2002 to 2004. The country average level of the indicator has not changed substantially in the last few years in most of the WHO European region. Eighty-nine per cent of people (including children) are exposed to PM10 levels exceeding the WHO air-quality guideline level (20 µg/m^3), giving rise to a substantial risk to children's health. For 14 per cent of the population, the EU limit value of 40 µg/m^3 is exceeded.

PM10 data from regular monitoring are not available for 31 countries (43% of the population) of the region, but an approximate assessment indicates that the pollution levels and corresponding health risks may be even higher in many of these countries (ENHIS, 2007).

[8] *The European Commission's Clean Air for Europe Programme.*

3.2.2 Air pollution effects from transport in EECCA and SEE

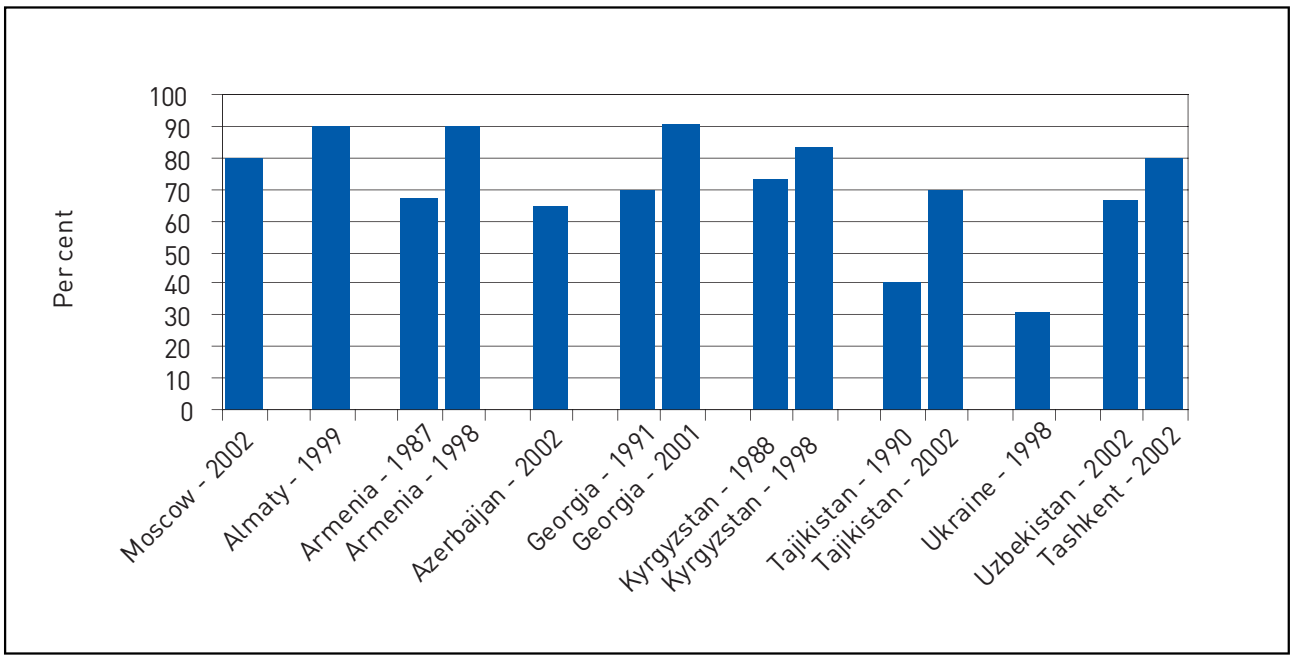
Air pollutant concentrations, including transport-related emissions, decreased in the 1990s in EECCA mainly due to the economic recession, but transport-related emissions decreased less than the decrease in transport volumes, indicating a reduction in average fuel efficiency (BRRT 2007a and BRRT 2007c). With economic recovery, this decline has ceased. Air pollution levels remain high, especially in large cities. In some EECCA capitals, transport is the dominant source of air pollutants (more than 80% of the total in Ashgabat, Dushanbe, Moscow, Tbilisi and Tashkent) and while it is a major source in others, e.g. Baku, Bishkek, Chisinau, Kyiv, Minsk and Yerevan (see figure 7). Road transport in Russian cities accounts for 70 to 75 per cent of total air pollutants and more than 90 per cent in large city centres (or 14.3 million tons of harmful emissions in 2003). Contributing factors include the age of the vehicle fleet, low-quality and high-sulphur content fuel, and the declining use of public transport. The Russian Federation's transport sector accounts for about 68 per cent of CO, 58 per cent of NOx, and 5 per cent of hydrocarbon emissions. The use of leaded petrol was banned in the Russian Federation in 2003.

Based on 2004 data, PM concentrations are exceeded in the Central Asian countries due to many sources of particulates, including road transport, the burning of low-quality coal for power generation, desertification and other sources of airborne particles (ECMT 2005a). Maximum allowable concentrations (MACs) are exceeded in cities of Kazakhstan, the Republic of Moldova, Ukraine and Uzbekistan for particles, nitrogen dioxide (NO_2), benzo(a) pyrene and formaldehyde. The MAC for NO_2 and dust is exceeded in 20 Kazakh cities (BRRT 2007a).

The level of air pollution in Kazakhstan and Kyrgyzstan cities is said to remain high due to several reasons, including outmoded production technologies and low-quality fuels. Some large cities and industrial centres in Kyrgyzstan (e.g. Bishkek) show annual average concentrations of formaldehyde exceeding MACs by 5 to 8 times, PM by 3 to 4 times and benzo(a)pyrene, by 30 to 60 times. Average daily exposure for the urban population of Belarus was estimated as follows: formaldehyde, 32–80 μg/m^3; NO_2, 160–384 μg/m^3; CO, 4.2–8.7 mg/m^3; and SO_2, 8–56 μg/m^3. The MAC was exceeded for NO_2 by a factor of three in 60 per cent of all towns, for CO in 15 per cent of towns and for PM in 40 per cent of Ukrainian cities (BRRT 2007a).

Air-quality data from the Russian Federation for the period 2002–2004 showed a total suspended particle (TSP) concentration in background urban locations of 244 μg/m^3 (for 98 cities with with 45 million residents) and a mean NO_2 concentration of 79 μg/m^3 (for 111 cities with 47 million residents). In 2002, the average annual concentrations of harmful air emissions exceeded MACs in 201 Russian cities (i.e. 62% of the Russian Federation's urban population). The Russian Federation's Air Pollution Index for large cities is increasing, mainly due to an increase in benzo(a)pyrene; 47 per cent of cities had benzo(a)pyrene concentrations over the MAC in 2004. Benzo(a)pyrene comes from forest fires, industrial production, use of diesel cars and waste incineration.

Figure 7: Transport-related air pollution emissions (in % of total emissions, for various EECCA countries, cities and years)



Source: UNECE 2006b

Precise estimates of health impacts for EECCA countries are not available at present because of the general lack of monitoring data, especially for PM10 and PM2.5 (ECMT 2005a). However, available data for some countries, e.g. the Russian Federation, show that up to 30 million people are exposed to elevated concentrations of ambient air pollutants including PM, benzo[a]pyrene and NO_2 (Dimitrov 2004). Recent WHO analyses indicated that 47 million Russians were exposed to NO_2 concentrations that were double the WHO guideline level (EEA 2007). Transport is responsible for an increasing share of these pollutants. The number of additional deaths attributable to road transport-related emissions in the Russian Federation of people over 30 is estimated at 25,000 to 28,000 per year.

Emissions from motorized transport were estimated to account for almost 50 per cent of the respiratory disease in Moscow (ECMT 2005a). In the EUR B and C subregions (which include most of the EECCA and SEE countries), outdoor air pollution is estimated to be responsible for 0.9 to 2.4 per cent of deaths of children (when considering acute respiratory infections only) and for 5.8 to 7.5 per cent of deaths for children between ages 0 to 4 (when considering all causes of mortality) (Dimitrov 2004).

3.3 Road traffic crashes and injuries

3.3.1 Overview

Road traffic injuries are the leading cause of death in children and young people in Europe and the rates have been described as "unacceptably high" (WHO 2007a). The cost of death and injury on the road has been estimated at 2 per cent of the GDP in high-income countries. The high costs are partly explained by the large number of young victims, which amplifies the economic losses in productivity and earnings.

About 104,000 people were killed in road crashes in 2004 (UNECE region), with around 2.2 million people injured in 1.8 million road crashes (UNECE 2007).

Road traffic injuries are ranked sixth in the causes of lost disability-adjusted life years and thirteenth in terms of cause of death in the general population. Road traffic injuries are the leading cause of death for the age groups 5–14 and 15–29. Cyclists and pedestrians account for a comparatively higher percentage of the deaths; this, however, is partly due to the fact that they circulate mainly in urban traffic, where the number of accidents is generally higher than on non-urban roads. Children are particularly vulnerable because they can cope less well with the dangers from traffic (UNECE/WHO Europe 2004).

Males, especially young ones, are at higher risk for road traffic crashes than females. Of young people who die in road traffic crashes, four out of five are male. This is related to their greater access to motor vehicles, including the riskiest ones (e.g. motorbikes) and they are more likely to engage in speeding and in driving under the influence of alcohol (UNECE/WHO Europe 2004). Young drivers (15–29 years of age) account for about 27 per cent of driver fatalities across OECD countries, although this group represents only about 10 per cent of the population. Death rates for drivers aged 18 to 24 are about double those of older drivers (ECMT 2006a).

Excess speed is the main road safety problem in many countries, contributing as much as one third of fatal crashes and aggravating the severity of non-fatal ones. ECMT (2006b) estimated that 50 per cent of drivers are driving above the speed limits.

The burden of road traffic injuries is unevenly distributed, with low- and medium-income countries in the eastern and southern parts of the European region being more severely affected than high-income countries in the northern and western parts. Within the higher-income countries, road traffic injuries affect socio-economically deprived people more, with research showing that children from households in the lowest socio-economic group are five times as likely to be killed as those from households in the highest socio-economic group (Social Exclusion Unit 2003).

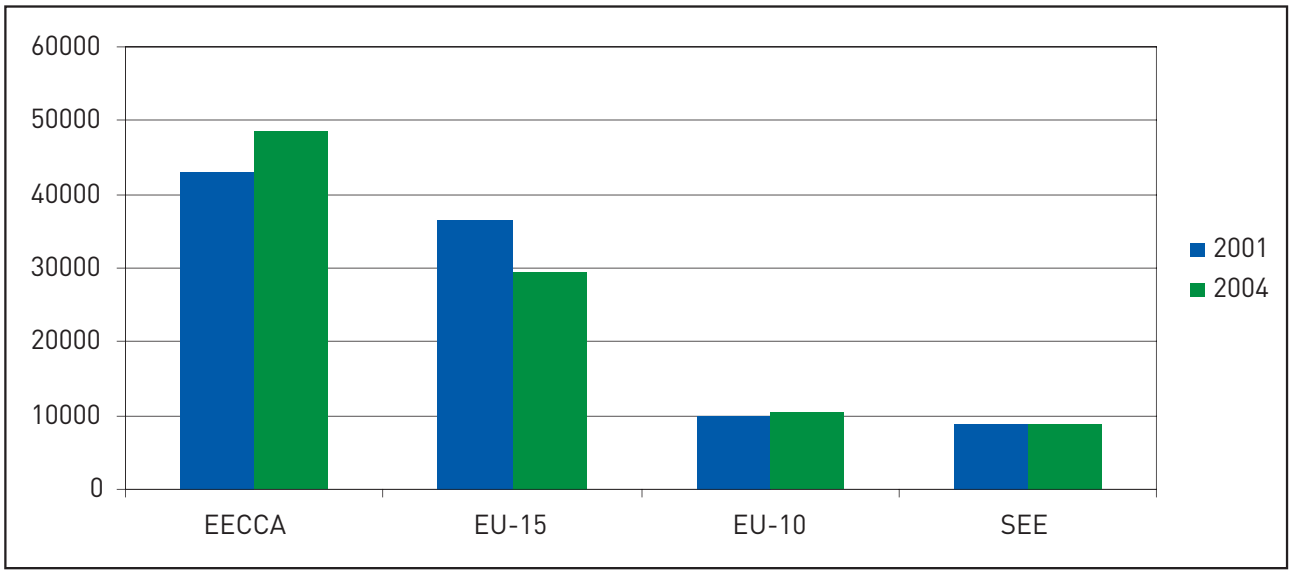
3.3.2 Trends

The mortality data show 1.5 times more deaths in EECCA than in EU-15. For the period 2001–2004, road fatalities remained about the same in EU-10 (approximately 10,000) and SEE (approximately 9,000), decreased in EU-15 (from about 36,000 to 30,000) and increased in EECCA (from about 43,000 to 48,000) (see figure 8). A similar trend can be observed in EFTA countries, with a continuous decline in number of road fatalities in the same period.

The average mortality rate per 100,000 population from road crashes in 2000 was 14.9 in EECCA, 10.2 in EU-15, and 13.6 in CSEC[9] countries. The Russian Federation has the highest mortality rate in the region, 20.0 per 100,000 population. From 2001 to 2004, the road fatalities per million population decreased from 90 to 75 for EU-15, increased from 140 to 145 for EU-10, was unchanged at 76 for SEE and rose significantly from 175 to over 200 in EECCA. Road fatalities per million passenger cars showed improvements in parts of the UNECE region, with the exception of EECCA. From 2001 to 2004, road fatalities per million passenger cars decreased from 750 to 700 in SEE and from 190 to 130 in the EU-15; they increased from 1,400 to 1,440 in EECCA (the situation improved in some EECCA countries, but not in Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan and Ukraine; see figure 9) (UNECE 2006b).

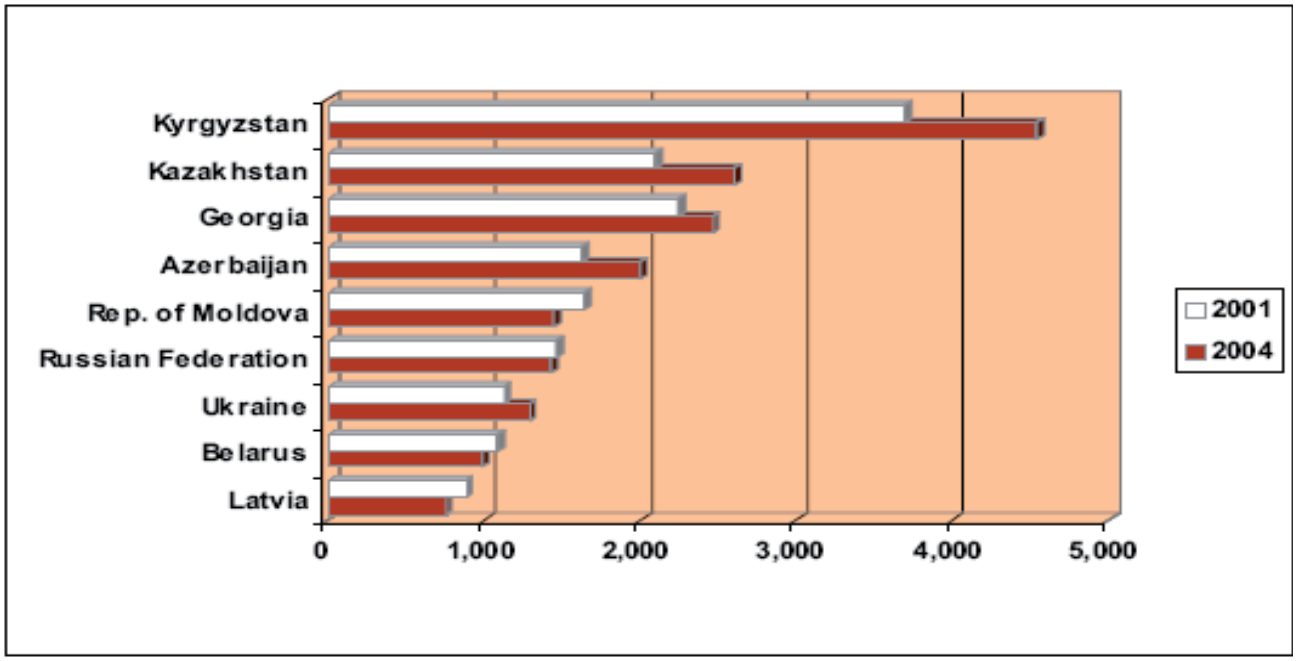
[9] *CSEC: Central and south-eastern countries, which comprise Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Montenegro, Poland, Romania, Serbia, Slovakia, Slovenia, the former Yugoslav Republic of Macedonia and Turkey (19 countries)*

Figure 8: Road fatalities by subregion, 2001–2004



Source: UNECE 2006b

Figure 9: Road fatalities per million passenger cars for eight EECCA countries and Latvia, 2001–2004



Source: UNECE 2006b

Although EECCA countries have a higher mortality rate from road crashes, the number of road crashes with injuries per 100,000 population reported in 2004 was lower (137) than for EU-15 (405) and SEE countries (122), indicating some under-reporting of road crashes with non-fatal injuries (UNECE 2007).

3.3.3 Road traffic crashes and injuries in EECCA and SEE

Road mortalities declined in the mid-1990s in several EECCA and SEE countries, probably due to the economic recession rather than road safety strategies. From 2000 to 2004–2005, SEE showed a slight decrease in the number of persons killed (-5%), with only Albania showing an increase in number of deaths (+13%, from 280 in 2000 to 315 in 2004) (figure 10).

In the period 2000–2004, EECCA showed a 21 per cent increase in persons killed in road crashes, from 41,168 to 49,715 deaths. At the country level, Azerbaijan (+36%), Kazakhstan (+53%) and Kyrgyzstan (+46%) had the highest percentage increase in the 2000–2004 period. Fatalities increased by more than 17 per cent between 2000 and 2004 in the Russian Federation. However, the data indicate that road fatalities in the Russian Federation peaked in 2003, showing a decline of about 4.5 per cent in 2005 as compared to 2003 (or -3.1% when comparing 2004 to 2003, a time interval with more exact data). (Ukraine, Belarus and the Republic of Moldova also indicate a peak for 2003 and a subsequent decline in 2004; see figure 11.)

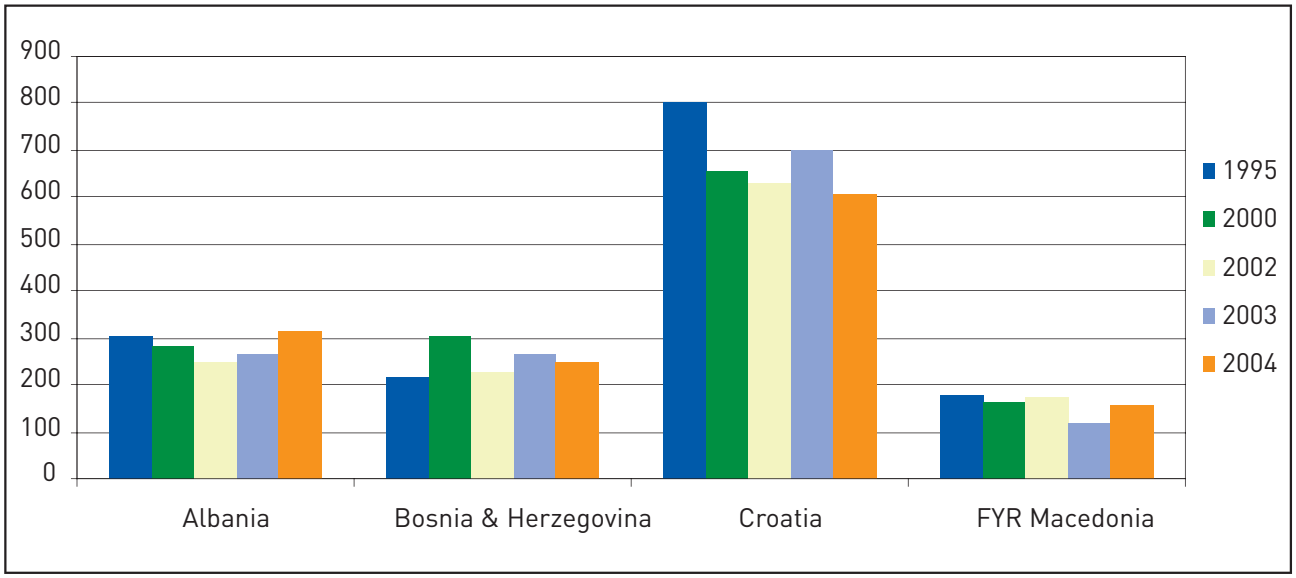
UNECE (2006a) reports that fatality rates (on a per capita basis) in EECCA are about two times higher than in other regions, even though traffic levels are much lower. In the Russian Federation, the chance of being killed in traffic is 10 times greater per vehicle than in Germany. Other EECCA countries have lower accident rates, perhaps because of their lower car ownership level (BRRT 2007c).

Road safety deaths and injuries were estimated to have costs equivalent to 2.5 per cent of the Russian Federation's GDP (Short 2006). The economically active 15 to 44 age group accounted for more than half of all road deaths. Furthermore, road traffic injuries are the second leading cause of death for children and young people (BRRT 2007c). In 2001, pedestrians accounted for 44.1 per cent of road deaths in the Russian Federation as compared to 29.6 per cent in the ECMT region, and mortality rates among pedestrians were also rising.

The use of alcohol was reported to be responsible for 18 per cent of the deaths and 20 per cent of the injuries from road crashes in 2001 in the Russian Federation (Dimitrov 2004). Most crashes in EECCA occur in urban areas; for instance, for 2001 84 per cent of all crashes involving injury in Georgia occurred in built-up areas. Excessive speed is a relevant factor: the urban speed limit in Azerbaijan, Belarus, The Republic of Moldova, the Russian Federation and other EECCA countries is 60 km/h, whereas good practice advocates 50 km/h in urban areas and 30 km/h in residential areas (Dimitrov 2004).

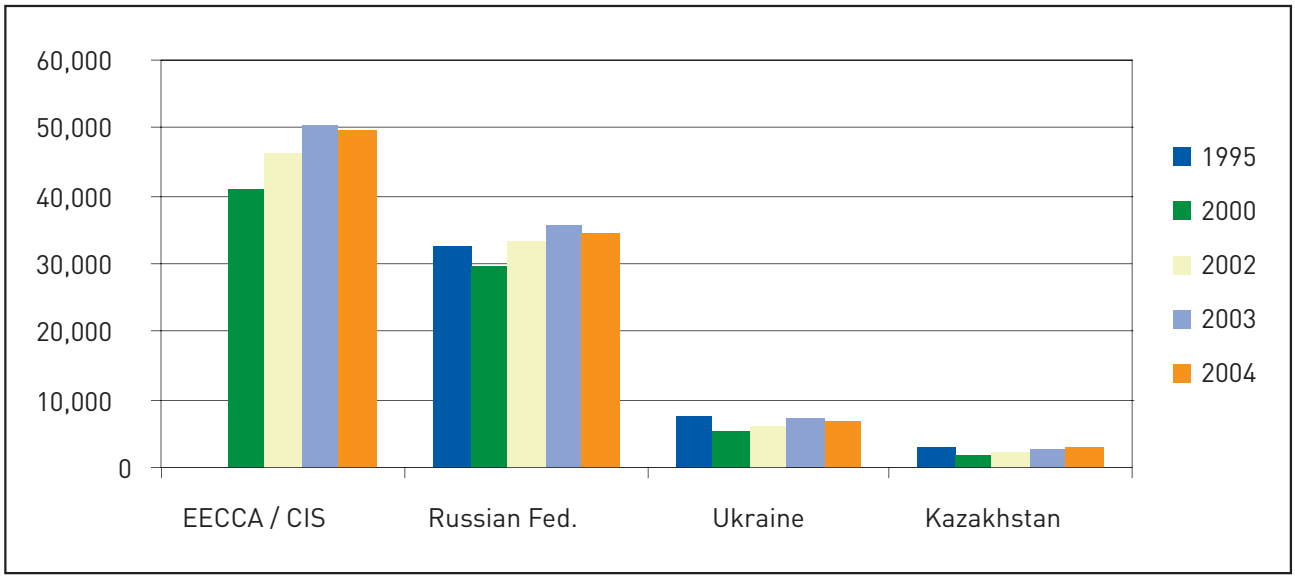
When compared to the ECMT average, the outcome of motor vehicle crashes is more severe in EECCA. For instance in the Russian Federation (2000), 159 pedestrians, 144 cyclists, 13 motorcyclists and 143 car drivers were killed per 1,000 injuries, compared to 87 pedestrians, 31 cyclists, 43 motorcyclists and 33 car drivers for the ECMT region. The reasons for the higher severity in EECCA probably include excessive speed, poor road and vehicle conditions, inadequate skills of road users and inadequate provision of emergency services (Dimitrov 2004).

Figure 10: Persons killed in road accidents in selected SEE countries



Source: UNECE 2006a and 2007; ECMT 2007

Figure 11: Persons killed in road accidents in selected EECCA countries

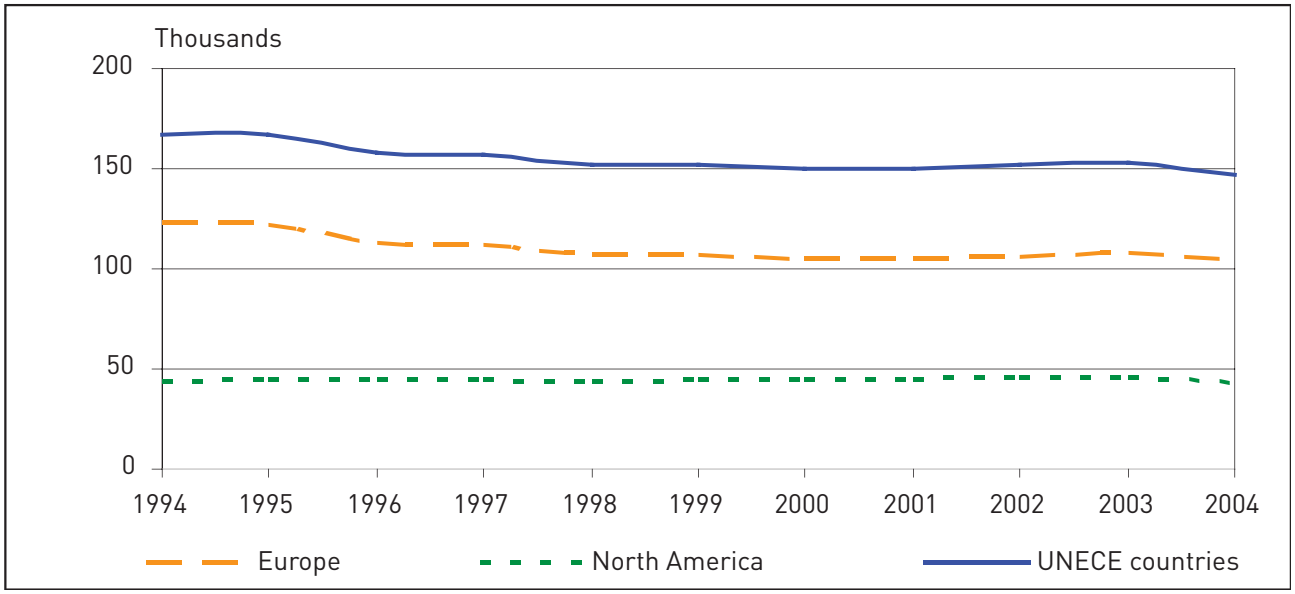


Source: UNECE 2006a and 2007; ECMT 2007

3.3.4 Road traffic crashes and injuries in Western Europe

Despite the differences between countries, mortality rates from road traffic injury have declined overall. In the early 1990s, mortality rose sharply in the eastern part of the European region (Racioppi et al 2004). This sharp rise may be attributed in part to the sudden increase in motorized transport and having numerous new and inexperienced drivers (Dora et al 2000). In Western Europe, although road traffic-related mortality has continued to decline, progress seems to have slowed in the past few years, including in the countries that have previously performed very well.

Figure 12: Deaths in road accidents, 1994–2004



Source: UNECE 2007

3.4 Effects of transport-sector noise

3.4.1 Overview

WHO guidelines[10] limit noise levels for residential areas to 55 dB(a) during the day and to 45 dB(A) during the night. Transport is the most important source of community noise across Europe.

Approximately 30 per cent of the EU-15 population is exposed to levels of road traffic noise of more than 55 dB(A). In general, the WHO guidelines for noise are often exceeded in EECCA and SEE on roads with high traffic loads.

Exposure to high noise levels has decreased in some countries since 1980 due to technological measures, noise barriers and adapted spatial planning. However, some of these achievements are likely to be offset by the expected growth in traffic.

In EECCA, noise pollution decreased in the 1990s due to reduced economic activity and improved technology at many industrial plants. Since the economic recovery, noise levels are increasing due to strong industrial growth and increasing related levels of transport activity (especially from motor vehicles and aircraft). The aged vehicle fleet and poor vehicle maintenance in EECCA (and in SEE as well) also contribute to higher noise levels (Dimitrov 2004). About 38 million people in the Russian Federation (out of a population of 144 million) are exposed to annoying transport-related noise. Noise from heavy traffic on urban motorways can exceed 80 dbA. In Moscow, 60 to 80 per cent of the population lives in areas with annoying levels of transport noise (ECMT 2005a).

3.4.2 Traffic noise effects

Noise can disrupt communication as well as impair hearing and sleep quality. Continuous noise and indoor noise above of 30 db(LAeq) and 45 db(LAmax), respectively, can affect sleep quality and cause fatigue and decreased performance. Prolonged or excessive exposure to noise (e.g. noise at 65–70 db(LAeq) can cause permanent medical conditions such as hypertension, and some have suggested that it causes ischaemic heart disease (Berglund et al 1999). A recent review highlighted the role of noise in a variety of behavioural and "social" responses such as annoyance, acute and chronic physiological as well as cognitive responses, and physiological and clinical effects (Van Kempen et al 2007).

Evidence indicates that high noise levels affect children's concentration and school performance: noise can interfere with learning, memorizing, solving analytical problems and acquiring reading skills. Reducing classroom noise levels has been shown to improve children's long-term memory and reading ability.

Noise from road, rail, and air transport is an important public health issue because many people are chronically exposed to high levels. A study estimated the external costs of noise exposure (in terms of decreased performance, hypertension and sleep disturbance) for the Zurich Airport at €17.7 million per year (1998 prices) and the external costs for Orly Airport in Paris (annoyance only) from aircraft noise at about €5 million per year. Cost-benefit analyses have shown that the benefits of abating the noise of cars and trains exceed the costs. For instance, the estimated cost to reduce noise from cars and trains (at source) in the Netherlands was about €2 billion, whereas the benefits in terms of reduced annoyance were estimated at €4–6 billion (UNECE/WHO Europe 2004).

3.5 Psychological and social effects

The psychological and social impacts of transport are often underestimated, even though these influence mobility behaviour. This is partly because current cost-benefit analyses for transport developments do not (usually) capture important qualitative elements of physical and social well-being, such as access to green spaces[11] and social support networks. Transport infrastructure can contribute to community severance, with roads dividing communities and making social interaction and maintenance of social networks difficult. In addition, reducing reliance on motorized transport may improve mental health and well-being by increasing access to green spaces and decreasing traffic noise and driving stress (BMA 1997 and Bird 2007).

While current assessment methods can better capture "quantifiable" impacts, such as direct impacts associated with road traffic injuries and directly attributable air and noise pollution impacts, it is likely that the other as of yet non-quantifiable effects have important health and economic impacts as well (BMA 1997). For example, about 25 per cent of road crash victims develop an accident-related psychological condition within the first year after an accident, including mood disorder, phobic travel anxiety and post-traumatic stress disorder. A study documented that 33 per cent of children involved in road crashes had post-traumatic stress disorder at 22 and 79 days after a crash (WHO 2004c).

[10] *Guidelines for Community Noise, World Health Organization, Geneva, 1999*

[11] *There are also indications that contact with nature and green spaces (including greener routes to school and work, and better views from windows) can have positive effects on mental health. Conversely, the loss of green space, especially within urban environments, generally is associated with decreases in people's sense of well-being and mental health (Bird 2007).*

The influences of fear of crashes on travel behaviour are also noteworthy. While in most countries the majority of children still walk to school, parents are increasingly prone to drive their children to school because of (real or perceived) fear of road traffic injuries, preventing children from walking and cycling. It is documented that walking rather than being driven to school has positive effects on children's psychological and physical well-being, and also supports their independence and social interaction (WHO 2004c).

3.6 Effects of transport-sector land use

In urban areas, 25 to 35 per cent of the land is used for transportation; the share can be even higher in suburban areas. This causes problems as it removes land from other uses, including recreation, housing and employment. Transport infrastructure can contribute to social isolation by dividing communities and cutting people off from essential services.

The direct land use for a four-lane motorway is about 2.5 ha/km, but the overall land use is about 8 ha/km to accommodate for noise protection, embankments, junctions and service areas. In addition, road and rail transport has an impact zone on both sides of the alignment due to noise, pollution or required compensation. Some major roads affect 50–80 m along both sides of the alignment, using up to 20 ha/km.

Across Europe, agricultural zones, forests and semi-natural and natural areas are disappearing in favour of the development of artificial surfaces, including transport infrastructure. EEA has estimated that in Europe, land use for transport infrastructures amounts to 3.2 per cent of the total new artificial cover. This figure is actually an underestimation, as linear features such as roads and railways are not included in the statistics, which focus only on area infrastructures (e.g. airports and harbours) (EEA 2005).

The dense public transport networks in the urban areas of EECCA are increasingly being replaced by infrastructure to satisfy the growing demand for private road transport. Yerevan can be used as an example: the total road area is 15.9 million m^2 or 7 per cent of the total city area. However, the city's asphalted areas are increasing, and road widening and the building of new parking spaces is generally realized by using roadside grass plots and green zones (Tsarukyan 2006).

In larger Russian cities, urban sprawl has become a major problem. One of the main reasons for this is a rising demand for improved housing conditions, but urban sprawl has been further exacerbated by growth in the number of private cars, which has considerably increased the mobility of the urban population and its access to remote urban and rural areas. As a result, the length of urban travel trips has increased, and along with it, transport costs (ECMT 2005a).

Land is withdrawn from other uses for transport activities. Moreover, transport infrastructure can divide homogeneous areas into "islands" and can isolate sensitive ecological areas. This affects biodiversity since it decreases habitats for a number of species and fragments the landscapes that support and connect them. It can also reduce the functionality of the habitats and the movement of the fauna.

3.7 Transport-related energy use and climate change

Motorized transport depends on fossil fuels, in particular oil products, which account for more than 98 per cent of the transport sector's energy consumption. Methane, although a fossil fuel, together with biofuels, is the most important alternative. The strong reliance on fossil fuels means that GHG emissions from transport are closely tied to transport demand (BRRT 2007c, Woodcock et al 2007).

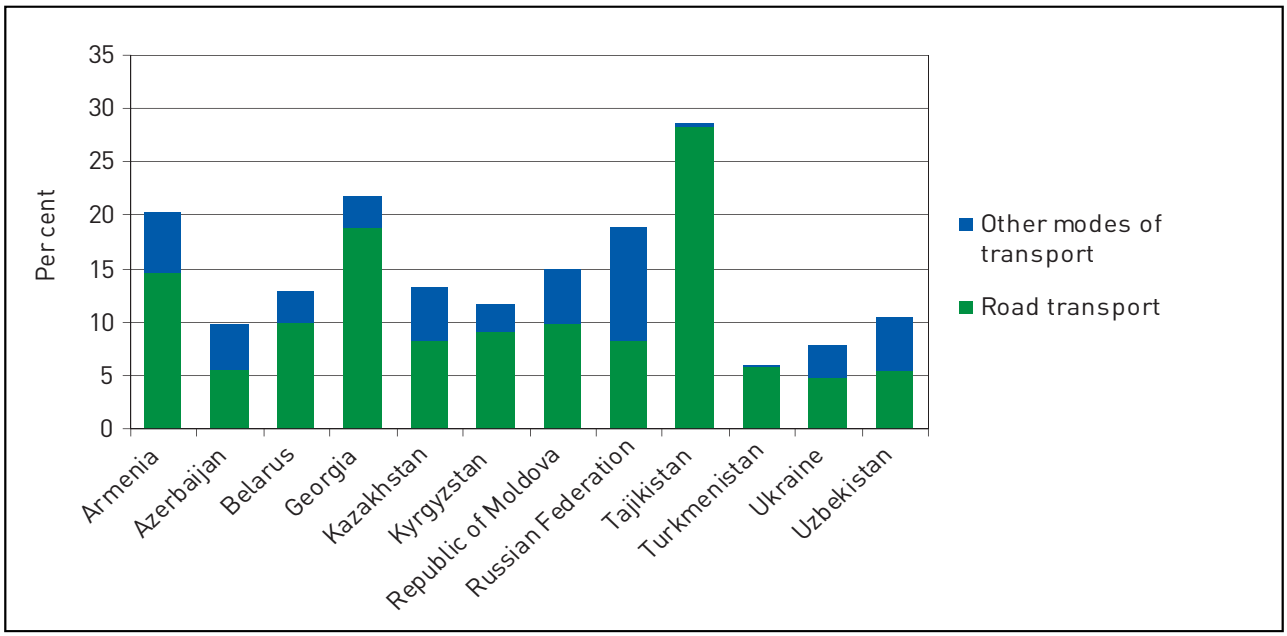
Energy consumption per capita for transport is 2 to 4 times higher in Western Europe than in EECCA and SEE (although energy consumption per unit of GDP tends to be significantly lower than in Western Europe). There is currently no cost-effective technology to remove carbon from exhaust, so heightened fuel consumption generally mean increases in CO_2 emissions. The transport sector ranks second for GHG emissions in Western Europe, accounting for 20 per cent of emissions overall. Transport accounts for 10 per cent of GHG emissions in SEE and 8 per cent in EECCA (BRRT 2007c and BRRT 2007d).

According to the International Energy Agency (IEA), transport-sector emissions increased by 412 million tons (31%) worldwide between 1990 and 2003, and grew by 820 million tons (26%) in OECD countries, accounting for 71 per cent of worldwide transport CO_2 emissions.

In the EU, the transport sector's share of CO_2 emissions in 1994 was 26 per cent, with about 8 per cent in CEE. During the period 1990–2000, transport's share of GHG emissions increased by 4 per cent in CEE and by 19 per cent in EU-15. Between 2003 and 2004, the increase of climate-changing GHG emissions from the transport sector, excluding international aviation and shipping, was 2.2 per cent.

In EECCA and SEE, total CO_2 emissions during the 1990s were estimated to be lower than in the rest of Europe, partly due to restructuring or closure of heavily polluting and energy-intensive industries as well as due to the overall decline in economic and transport activities in this period. However, with the increase in economic activity and growing transport demand, transport-related CO_2 emissions were expected to grow after 2000 (OECD. 2007).

Figure 13: Energy used in transport in EECCA countries, 2000 (in percentage of total energy used)



Source: UNECE 2006a

3.7.1 Energy use

Since the end of the 1990s, energy consumption has been increasing across Europe. Increasing gas prices have made coal more competitive, and GHG emissions have begun to rise again. This trend may continue if no additional policies and measures are implemented (BRRT 2007d). Transport energy consumption in the EEA-17 area grew by about 2 per cent per year during the period 1990–2000, and equalled 365 Mtoe (million tons oil equivalent) in 2000 (some 35% of all energy use). As a consequence of the growth in energy consumption, CO_2 emissions from transport also continued to increase.

North-Western Europe (NWE)[12] has the highest and fastest growing transport energy consumption per capita. This is rapid growth can be explained partly by high passenger transport intensity and partly by energy consumption in freight transport. Even though the freight transport intensity in NWE is low, this is balanced by the much higher GDP. The energy consumption per capita is around 75 per cent lower in EECCA and 50 per cent lower in SEE. The low level of car ownership and air transport use in these countries are the main explanations for this.

In SEE, energy consumption grew by 31 per cent from 1993 to 2003, reflecting a strong growth in GDP (38%). In 2003, transport used about 26 per cent of the total energy, with road transport accounting for about 91 per cent of that energy use (Albania's transport system used about 40% of the energy consumed; transport sector in Montenegro and Serbia only used 18% (BRRT 2007c).)

Transport-sector energy consumption in EECCA declined by only 7 per cent between 1993 and 2003, even though transport volumes decreased markedly (indicating that transportation was becoming less energy-efficient, perhaps due to the aging vehicle fleet). In 2003, the transport sector accounted for 17 per cent of total energy consumption, ranging from 8 per cent in Turkmenistan to 36 per cent in Tajikistan (as compared to 21% in the Russian Federation and 29% in the EU–25). Road transport accounts for most of the energy used by the transport sector (about 79%) (BRRT 2007c). There is significant country variation: road transport used 99 per cent and 43 per cent of Tajikistan's and the Russian Federation's transport sector energy, respectively (see figure 13) (UNECE 2006b).

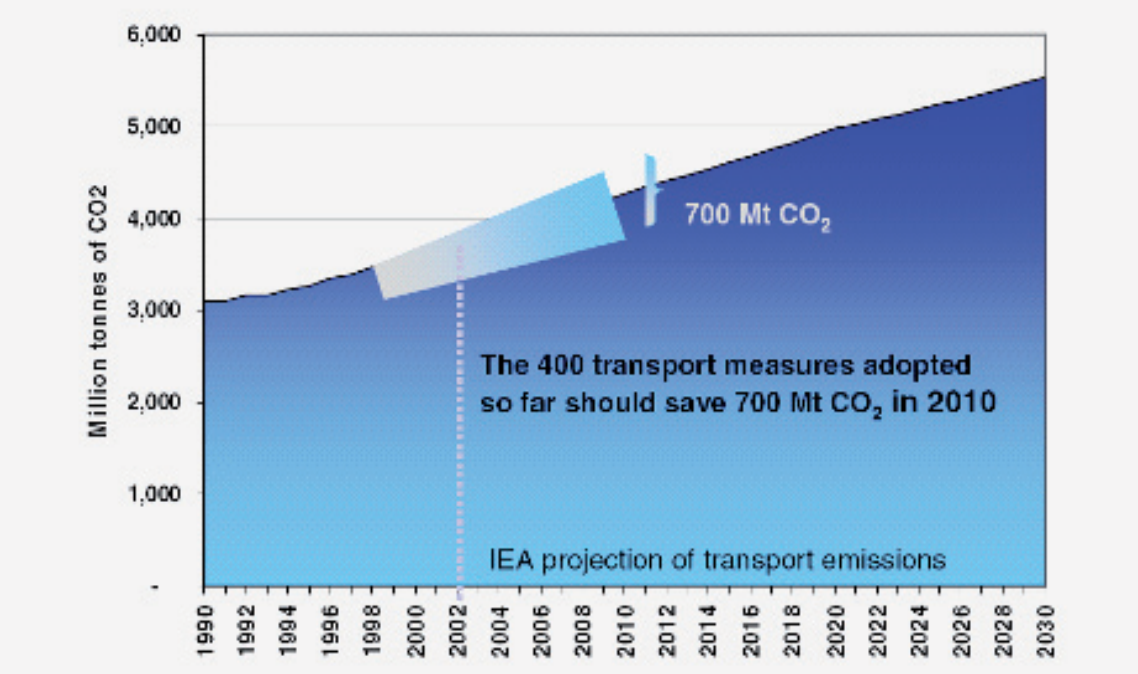
3.7.2 Carbon dioxide emissions

Although some countries have made significant efforts to cut transport-sector CO_2 emissions, emissions from the transport sector have continued to increase steadily over the past 10 years (ECMT 2007). This is against a background of declining total CO_2 emissions during the 1990s across the region, mainly due to the introduction of market economies and the consequent restructuring or closure of heavily polluting and energy-intensive industries (BRRT 2007a).

This trend is set to continue: ECMT has estimated that transport-sector CO_2 emissions in ECMT countries would grow by approximately 1.9 per cent per annum between 2002 and 2010, with the possibility that by 2010 transport-sector CO_2 emissions from ECMT/OECD countries would be 1.2 billion tons higher than 1990 levels (ECMT 2007).

[12] *NWE data covers the period 1990–2002 for the EU-15, the Czech Republic, Hungary, Norway Poland, Slovakia, Slovenia and Switzerland.*

Figure 14: OECD/ECMT transport-sector emissions and the potential impact of policies identified



Source: ECMT, based on IEA (2004)

An analysis of a database of over 400 abatement policies introduced or under development since 1990 suggests that the measures so far adopted might cut 700 million tons from annual CO_2 emissions by 2010, just over half the projected increase in emissions between 1990 and 2010. Figure 14 gives a crude indication of the significance of these potential savings, with the lighter shaded section showing the 700 million tons in the context of IEA projections of total transport emissions. It is not clear, however, how many of the measures identified may have been included in the "business as usual" projection shown (ECMT 2007).

In 1994, transport's share of CO_2 emissions was 8 per cent in the Central European Initiative (CEI) countries[13] (it was 26% in the EU). During the period 1990–2000, transport-sector GHG emissions increased by 4 per cent in CEE and by 19 per cent in EU-15. In EECCA and SEE, transport volumes are recovering and generally increasing, with road transport (including private passenger transport) becoming increasingly attractive. Because motor vehicles generate more CO_2 compared to other modes, road traffic's share (77%) of transport's CO_2 emissions is higher than its share of passenger-km and ton-km (UNEP et al 1999). In the Russian Federation, transport (including pipelines) was responsible for 15 per cent of CO_2 emissions (53% was attributed to road transport) in 2007.

Transport's share of CO_2 emissions is gradually increasing in all regions of the world: its share of global emissions increased from 22 per cent in 1990 to 24 per cent in 2003. Its share is highest in the more affluent OECD countries, amounting to 30 per cent in 2003 (ECMT 2007). Between 1990 and 2000, transport GHG emissions in the EU-15 increased by 19 per cent, whereas emissions in SEE countries saw a smaller increase, of 4 per cent. Forecasts show that CO_2 emissions are likely to continue to rise due to the growth in passenger and freight transport (UNECE/WHO Europe 2004). (See also sections 2.3 and 2.4.)

[13] *The CEI countries are Albania, Austria, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Hungary, Italy, Republic of Moldova, Poland, Romania, the Slovakia, Slovenia, the former Yugoslav Republic of Macedonia and Ukraine.*

3.7.3 Climate change

Extreme weather and climate events are forecasted to become more frequent and intense, associated with increases in hospital admissions during hot periods (IPCC 2007). In 2000, the WHO Burden of Disease assessment estimated more than 160,000 deaths worldwide due to climate change. The heatwave in 2003 caused about 25,000 extra deaths in the aging population in Europe. A European study found that increases in temperature increased salmonellosis cases by an estimated 30 per cent in 10 European countries (UNECE/WHO Europe 2004).

With climate change (i.e. gradual climate change) and climate variability (e.g. extreme events) increases are expected for temperature-related illnesses and mortality, vector-borne diseases, illnesses related to water and food contamination, and malnutrition, as well as unintentional injuries and disability due to extreme weather events (e.g. from floods). As well, climate change is expected to exacerbate mental health, stress, and quality of life issues, e.g. through post-traumatic stress related to extreme weather events (IPPC 2007).

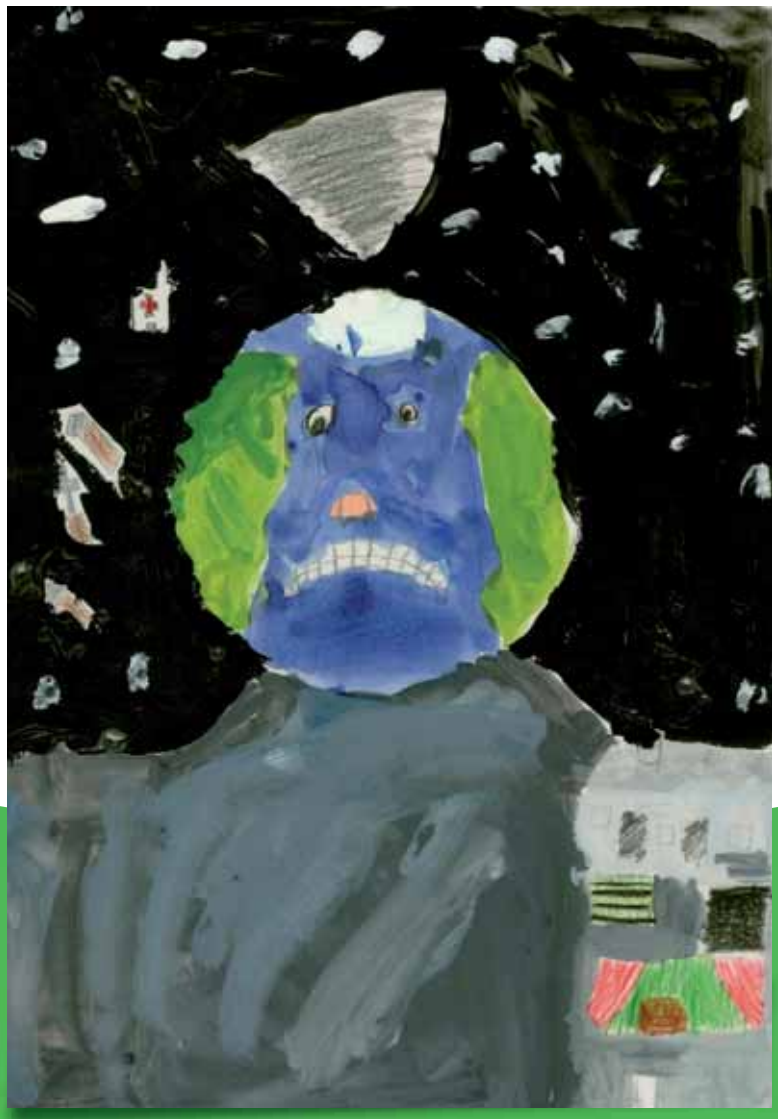
3.8 Effects related to transport subsidies and external costs

Public subsidization of transport systems can affect the environment and health by lowering the cost of transport to the user, which can encourage additional transport and an increase in the overall volume of traffic. Subsidies can also have positive impacts if they encourage a shift from the car to public transport.

Transport subsidies (when defined as direct transfers and tax deductions from public budgets) can include infrastructure spending, other direct transfers (e.g. direct support to operators), differences in fuel taxation for different modes and value-added tax (VAT) exemptions for certain segments of the transport market.

Transport systems are partly publicly funded (or "subsidized"), and they create external costs (e.g. pollution) that are not paid by the transport user but by the taxpayers, irrespective of their level of transport use. Such external costs typically include noise, air pollution, damage caused by crashes, road traffic injuries, physical inactivity (through restrictions to cycling and walking) and climate change. Road and air transport have the highest external costs and rail or inland waterways (where available), the lowest per transport unit. Because of the costs related to road traffic injuries and air pollution, road passenger transport has the highest overall external costs (OECD et al 2004).

Cheaper transport affects people's choice of residence, workplace, shopping and business locations (e.g. retail stores no longer need to be located close to customers). The general consequence is longer distances between homes, workplaces and shopping facilities as well as more transport. The cost-effectiveness of public transport depends on population density. Low population density (e.g. as in suburbs) makes public transport more expensive and reduces the service quality. Urban sprawl fosters a modal shift away from public transport and a higher dependency on cars. Cheaper and faster transport is a main driver of urban sprawl (EEA 2007a).



William Ben Embarek (grade 6G)

4 - Progress made in Policy Integration, Sustainable Urban Transport and Demand Management (1997–2007)

4.1 Integration of environmental and health aspects into transport policy

4.1.1 *Policy integration in Western Europe*

There have been significant developments in the integration of environment and health issues into transport policy in Western Europe in the last 10 years. Sustainable development became a fundamental objective of the EU when it was included in the Treaty of Amsterdam as an overarching objective of EU policies as of 1997. This meant that sustainable development issues had to be integrated into EU policies, including those on transport. And in 1999, the Cardiff European Council defined its strategy on integration, highlighting five sectors in which measures should be pursued, namely: (a) growth in CO_2 emissions from transport; (b) pollutant emissions and their effects on health; (c) anticipated growth in transport, in particular due to enlargement; (d) modal distribution and its development; and (e) noise in transport (EC 2001).

At the Gothenburg Summit[14] in 2001, EU leaders launched the first EU sustainable development strategy based on a proposal from the European Commission. This placed emphasis on shifting the balance between modes of transport at the heart of the sustainable development strategy (EC 2001). The 2001 strategy was composed of two main parts. The priorities were:

- To combat climate change
- To ensure sustainable transport
- To address threats to public health, such as chemical pollution, unsafe food and infectious diseases
- To manage natural resources more responsibly and stop biodiversity decline
- To combat poverty and social exclusion
- To meet the challenge of an ageing population.

The second part of the strategy revised the way that policies were made, calling for a new approach to policymaking that would ensure that the EU economic, social, and environmental policies mutually reinforced each other. The central instrument developed for this purpose was the obligation for the European Commission to submit each new policy proposal to an impact assessment procedure (EC 2007b).

Impact assessment is a process aimed at structuring and supporting the development of policies. It identifies and assesses the main options for achieving objectives and analyses their likely economic, environmental and social impacts. It outlines advantages and disadvantages of each option and examines possible synergies and trade-offs.

The Commission established two important political considerations:

- To consider the effects of policy proposals in their economic, social and environmental dimensions
- To simplify and improve the regulatory environment.

The Commission introduced a new method of impact assessment in 2002, integrating and replacing previous single-sector type assessments. Impact assessment is now applied to major Commission proposals, including:

- Regulatory proposals
- Other proposals having considerable economic, social, and environmental impacts
- Proposals having a major impact on particular groups
- Proposals representing a major change or policy reform, with the latter including proposals such as white papers, expenditure programmes, communications on policy orientations and negotiating guidelines for international agreements (UNECE 2007b).

Also of relevance is the EU "Transport and Environment Reporting Mechanism" (TERM), an indicator-based reporting mechanism initiated during the United Kingdom's presidency in 1998. Annual transport and environment indicator reports are produced by EEA and supported by a statistical compendium issued by Eurostat. The aim of TERM is to enable policymakers to gauge how integration is progressing in the transport sector. A first TERM report described progress in 31 indicators benchmarked against key policy objectives and targets (EEA 2007).

In addition, progress has been made on strategic environmental assessment (SEA). SEA is undertaken much earlier in the decision-making process than environmental

[14] *The final European Council summit of the Swedish EU Presidency (June 2001).*

impact assessment (EIA) of a given project, and it is therefore seen as a key tool for sustainable development. The Protocol on SEA[15] will require its Parties[16] to evaluate the health and environmental consequences of their official development plans and programmes and to involve health authorities in this process. The Protocol also provides for extensive public participation in government decision-making, in numerous development sectors (UNECE 2007b).

Also, in 2001, the EU White Paper on transport (European transport policy for 2010) was published. Built on the conclusions of the Gothenburg Summit, this White Paper stipulated that "The transport system needs to be optimized to meet the demands of enlargement and sustainable development. A modern transport system must be sustainable from an economic and social as well as an environmental viewpoint".

The three main subjects in the White Paper were (a) modal shift and cleaner urban transport policies, (b) pricing and (c) alternative fuels. An evaluation was commissioned to assess general European transport and environmental trends, as well as the (likely) effect of the White Paper in realizing a favourable change in these trends. Annema (2005) summarized the key issues and progress achieved to date as follows:

Modal shift is seen in the White Paper as an important way to meeting economic, social and environmental goals. However, policy scenarios have shown that modal shift measures (e.g. targeted investments in rail and inland waterways) are unlikely to result in modal shift effects in passenger transport on a European level, while the modal shift impacts in freight transport on a European level are very modest (Annema 2005).

The White Paper aimed to improve pricing and infrastructure policies so that transport inefficiencies, e.g. congestion, pollution and accidents, would largely disappear over time. However, the progress in restructuring charges towards better internalization of external costs in the EU has been slow.

The White Paper promoted the use of biofuels, compressed natural gas and hydrogen as lower-emission alternatives that could make transport less dependent on oil. Studies show that biofuels and hydrogen indeed offer the potential for a transport system with lower CO_2 emissions and, in the case of hydrogen and compressed natural gas, lower urban air polluting emissions (Annema 2005). However, biofuels are not considered a sustainable alternative fuel source as their cultivation competes with food crops, endangers biodiversity and has negative impacts on prices of basic food crops.

The European Commission reviewed its transport policy in 2006 (EC 2006) as a mid-term evaluation of whether the objectives of the White Paper could be achieved or whether adjustments were necessary. In particular, the 2006 review focused on whether the broad environmental and health objectives could be achieved by the focus on technological solutions, or whether more of a focus was needed on encouraging shifts to more environmentally friendly modes of transport. While unlike in the White Paper of 2001, a much stronger emphasis was placed on technological solutions, the review also concluded that it remained the common challenge for all major cities to reduce congestion, accidents and pollution at the same time as transport was increasing. The publication of a Green Paper on urban transport, to identify potential European added value to action at the local level, was announced.

Alongside these developments, EU enlargement presents significant challenges to policy integration across the European region. Although the new Member States from Central Europe and the Baltic tend to have inherited transport systems that encourage rail, the distribution between modes has tipped sharply in favour of road transport since the 1990s. EU enlargement will have a considerable impact on the demand for mobility. This will involve greater efforts to gradually break the link between transport growth and economic growth, and will make for a modal shift, as called for by the Gothenburg Summit (EC 2001).

Finally, in 2006 the European Council adopted an ambitious and comprehensive renewed sustainable development strategy for an enlarged EU. It builds on the Gothenburg strategy of 2001 and sets out a single, coherent strategy on how the EU will more effectively meet its long-standing commitment to meet the challenges of sustainable development. The renewed strategy sets overall objectives, targets and concrete actions for seven key priority challenges for the period up to 2010, many of which are predominantly environmental, including climate change, clean energy and sustainable transport (EC 2007b). Also in 2006, the Finnish Ministry of Transport organized a workshop in the context of the Conference on "Health in All Policies" (during the Finnish presidency of the EU). The three sectors represented at the workshop discussed opportunities arising from shared policy goals as well as further development tools and mechanisms that could support greater policy integration between transport, health and environment (WHO/United Nations Economic and Social Council 2007).

4.1.2 Policy integration in EECCA and SEE

Overall, policy reform and integration for sustainable transport in EECCA and SEE has been slow in the period 1997–2007. But there has been some limited progress. For instance, there is now a clearer understanding of environmental conditions and pressures, and this has resulted in more specific policy. One example is the Transport Strategy of the Russian Federation till 2020,

[15] *The Protocol on Strategic Environmental Assessment to the Convention on Environmental Impact Assessment in a Transboundary Context.*

[16] *The Parties currently include Albania, Bulgaria, Czech Republic, Finland, Germany, Norway and Sweden.*

which calls for transport policy to be based on principles of sustainable development and highlights the need for fiscal reform, the gradual application of the polluter-pays principle and the internalization of external costs of transport. The Federal Programme, "Modernization of the Transport System of the Russian Federation (2002–2010)", is also noteworthy in that its stated objective is the "comprehensive improvement of environmental sustainability, the economy, and transport system safety" (ECMT 2005a). It should be noted that there are some procedures in place to improve the integration of environmental and health concerns into transport policies. In Armenia, Kyrgyzstan, the Republic of Moldova, Tajikistan, Ukraine and Uzbekistan, transport and environment issues are discussed in inter-ministerial working groups and the relevant ministries are in regular contact. In about half the EECCA countries, transport ministry officials have received some environmental training and have an environmental unit in their ministry.

One reason for the limited progress is that the need for economic revival (especially in EECCA) in the period 2000–2007 eclipsed environmental goals (OECD 2006 and 2007). Other challenges hindering environmental and health performance and policy integration in some EECCA and SEE include: (a) fragmentation of the policymaking process (often ad hoc, poorly coordinated and donor-driven); (b) the lack of appropriate environmental criteria, indicators, and methodologies; and (c) the lack of implementation regulations with concrete targets. Overall, regulations (albeit extensive) are considered inconsistent and unenforceable across EECCA, and are in need of streamlining. Also, the vertical institutional settings do not facilitate intersectoral collaboration.

Overall, environmental institutions (and other institutions as well) are characterized by weak authority, outdated management and decision-making practices, still inadequate if increasing budgets and resources, and shortages of skilled staff (which in turn make it difficult to attract and retain qualified staff) in certain countries. The environmental institutions have been subject to frequent restructuring and organizational instability. For example, the Russian Federation's environmental agencies and executive branch were reorganized in 1994, 1996, 2000, and 2004. This has entailed the frequent replacement of managers and the loss of institutional memory, and has tended to result in a low commitment to improve environmental policy and regulation. The system is still vulnerable to corruption (OECD 2007). Environmental authorities continue to focus on enforcing legislation rather than on achieving defined targets for protecting human health and the environment.

In the health sector, ongoing reforms of the health system have given comparatively lower priority to public health and primary prevention; as a consequence, instruments are scarce.

Many environmental management responsibilities were devolved to the subnational level, leading to a further decline in the number of staff for inspection and enforcement as well as confusion about environmental functions at different levels of government. Decentralization of responsibilities has to some extent occurred ahead of adequate fiscal allotments (OECD 2007). There is low capacity at the subnational level, poor horizontal and vertical coordination, and a lack of incentives for the regulated community to comply with environmental legislation.

There is also a lack of implementation capacity, especially at the subnational level. Plans generally do not prioritize actions. Strategic and financial planning are weak at both the national and local levels, with public funds often being spent without clear frameworks and on too many programmes. Compliance is generally low (OECD 2007, 2006, and 1999 and BRRT 2007c). International conventions are routinely signed, but implementation continues to lag.

In general, EIA practice is still far from international best practice. Currently, the State environmental review only aims to verify project compliance with environmental laws and regulations. In some EECCA countries, EIA is not always being applied to investments in the transport sector (OECD 2007).

SEA has emerged as an important tool to integrate environmental concerns into plans and programmes (and even into policies). The EECCA and SEE countries are gaining experience with the SEA tool. The former Yugoslav Republic of Macedonia, for instance, has applied an EIA/SEA process on transport corridors Nos. VIII and X, and the Russian Federation has established a methodological basis for SEA (OECD 2006 and 2007). Four EECCA countries have signed the Protocol on SEA, and several initiatives have been launched, e.g., capacity development needs in SEA have been identified, strategies elaborated, and training manuals prepared for Georgia, the Republic of Moldova and Ukraine. Several pilot SEAs have been implemented (in Armenia, Belarus and the Russian Federation). New legislation to support SEA has been drafted in Georgia and SEA legislation adopted in Armenia. Notably, however, there is still insufficient practical guidance to conduct SEA, and much more training and experience with the SEA tool is needed (OECD 2007).

The SEA and EIA systems are still quite technocratic, with little public involvement. The SEA tool is constrained by the limited openness to public participation of the planning systems. The Aarhus Convention[17] has been ratified by most EECCA and SEE countries. Several are developing mechanisms for public participation, but many Governments are still reluctant to allow for such participation (OECD 2007).

[17] *The UNECE Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters.*

Economic instruments for policy implementation generally focus on revenue-raising as opposed to changing environmental behaviour. Information management does not satisfy policy and operational needs. Monitoring is not demand-driven and monitoring capacity is insufficient, while weak institutional coordination has resulted in duplication of parameters being monitored, incompatible data collection and fee-based data exchange. Many countries publish state-of-the-environment reports, but these are of mixed quality and make limited use of policy-linked indicators (BRRT 2007e).

4.2 Sustainable urban transport policy issues

Urban sustainability objectives entail looking at how people and goods move from one place to another. Most people in the UNECE/WHO Europe region live in cities, and most transport-related environmental and health problems occur in cities and their surroundings. The general trend is for the urban population, jobs and commercial development to move to the low-density periphery, which tends to generate more private vehicle trips, more congestion and fewer trips by public transport, walking and cycling. The quality of the urban environment (e.g. ground-level ozone, particulate emissions and noise) and the health of inhabitants are increasingly at risk. Policy instruments to promote sustainable urban travel generally include regulatory (e.g. parking restrictions), pricing (e.g. congestion pricing and fuel taxation) and technological measures (e.g. telematics), so as to:

- Integrate land use and transport planning
- Promote public transport
- Encourage walking and cycling in urban areas
- Manage growth in private car use (ECMT 2002).

In EECCA (and to a lesser extent, in SEE), the rail and public transport infrastructure is still in place, population centres are still oriented along public transport axes, and many cities still show high market shares of public transport. Current trends, however, show a move away from cleaner forms of transport – e.g. trams, subways and non-motorized transportation – to private car use.

4.2.1 Transport-sector air pollution

4.2.1.1 Regulatory framework

The UNECE region addresses the major air pollutants under the Convention on Long-range Transboundary Air Pollution (CLRTAP) and its eight protocols. Each Party to the Convention is required to develop relevant policies and strategies, including air-quality monitoring and management systems.

The objectives for air quality are formulated in the EU Air Quality Framework Directive and its daughter directives (EC 1996). These directives set out to control levels of certain pollutants and to monitor their concentrations. The EU Framework Directive sets common objectives and basic principles, with the daughter directives setting limit and target values for key pollutants. The first three daughter directives set limit values for SO_2, PM10, NO_2, NOx, lead, CO and benzene as well as target values for ozone. A fourth daughter directive, issued in 2004, sets target values for benzo(a)pyrene, cadmium, arsenic, nickel and mercury. The Framework Directive and its daughter directives require Member States to list the areas where limit values are exceeded and then set programmes to attain the limit values within the time limit.

Another key element of EU legislation is the National Emission Ceilings Directive (EC 2001), which sets emission ceilings for SO_2, NOx, ammonia (NH3) and VOCs for 2010. Member States are obliged to prepare a national programme presenting their approaches to achieve the emission ceilings. EU sectoral emission legislation sets emission standards for specific source categories (e.g. EU directives controlling emissions from vehicles, EC 1998).

As of 2007, nine EECCA countries had signed the CLRTAP: Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, the Republic of Moldova, the Russian Federation and Ukraine. Belarus, Russian Federation and Ukraine have also accepted the first three protocols to CLRTAP. In 2002, the Republic of Moldova ratified the Protocols on Heavy Metals and Persistent Organic Pollutants (POPs) (OECD 2007). As of 2004, Belarus had complied with its protocol commitments: its SO_2 emissions had reached 83 per cent as compared to 1980 and NOx emissions had reached 47 per cent as compared to 1987. SEE countries have also signed the CLRTAP. Bosnia and Herzegovina, Croatia, Montenegro, and Serbia have accepted the first protocol. Croatia has also accepted the Protocols on Sulphur, Heavy Metals and POPs, and has signed the multi-effect Gothenburg Protocol[18] (see annex IV).

The reduction targets under the Gothenburg Protocol are shown in table 4. Progress related to ozone precursor emissions, PM precursors and primary PM10 emissions, as well as acidifying and eutrophying precursor emissions, is summarized below.

Also of relevance is the European Auto-Oil II Programme (AOPII), which was developed to make an assessment of the future trends in emissions and air quality and to establish a consistent framework within which different policy options to reduce emissions could be assessed. This is thought to have led to the introduction of less polluting vehicles and fuels, by focusing on 10 "auto-oil" cities and their nine host countries across the EU region (EC 2000c).

[18] *1999 Gothenburg Protocol to Abate Acidification, Eutrophication and Ground-level Ozone.*

Table 4: Emission reduction targets for the Gothenburg Protocol, 1990–2010 (percentage)

	Western Europe	Central and Eastern Europe	EECCA
Acidification (SO_2, NO_x and NH_3)	-56	-40	-40
Eutrophication (NO_x and NH_3)	-36	-10	-25
Ozone precursors (NO_x, VOCs*, CO and methane)	-53	-21	-36

Source: BRRT 2007a

* Volatile organic compounds.

4.2.1.2 Air quality: general progress in Western Europe

A number of technical and legal measures implemented since 1990 – notably the ban of lead in petrol, the decrease in the sulphur content of fuels and emission standards for vehicles – have led to a reduction of some vehicles' exhaust emissions (WHO/UNECE 2004). Perhaps the most significant development is that since 1 January 2002, all petrol sold in the EU has been unleaded. Since 1 January 2005, the limit on the sulphur content of petrol and diesel has been set at 50 ppm and Member States are required to start phasing in ultra-low sulphur fuel with a maximum of 10 ppm sulphur content (EC 2007).

In 2007, the European Commission proposed new standards for transport fuels that will reduce their contribution to climate change and air pollution; the Commission also advocated greater use of biofuels. The new standards will make petrol, diesel, and gasoil "cleaner" and will also allow the introduction of vehicles and machinery that pollute less. Suppliers will have to reduce GHG emissions caused by the production, transport and use of their fuels by 10 per cent between 2011 and 2020. This is predicted to cut emissions by a cumulative total of 500 million tons of CO_2 by 2020 (EC 2007).

Despite this generally positive progress, the forecasts for continued traffic growth mean that the positive impact of the implementation of regulations and improved technical measures may be offset by increased emissions due to traffic growth. If emission ceilings and air-quality objectives are to be met, technical measures will need to be complemented by economic and structural actions, which act to reduce emissions from road transport and other mobile sources (WHO/UNECE 2004).

4.2.1.3 Air quality: general progress in EECCA and SEE countries

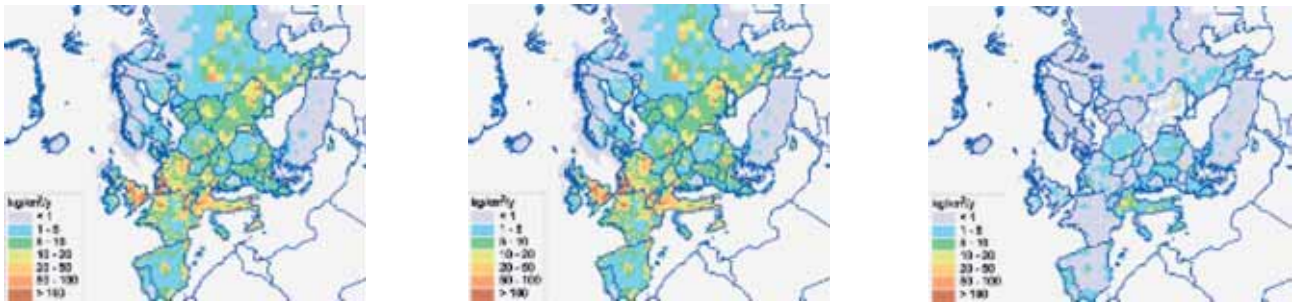
As of 1999, certain countries (e.g. Belarus, Croatia and Ukraine) indicated that their priorities were renewing the vehicle fleet, regulating imports of vehicles, enforcing the use of catalytic converters, and improving and controlling more strictly vehicle maintenance (UNEP et al 1999). In general, EECCA and SEE are gradually applying the strategies and standards for fuel quality and vehicle emissions used in Western Europe, including improving fuel quality, phasing out leaded petrol, reducing fuel sulphur content, introducing and strengthening vehicle emission regulations, and improving vehicle inspection and maintenance. If the type of activities and the degree of implementation differ between countries, general progress has been made.

4.2.1.4 Air quality: specific progress

Lead

Lead additives in gasoline have been the key source of lead in the European atmosphere over the last decade. However, progress has been made with regards to banning the use of leaded fuel. The Aarhus Declaration on the Phase-out of Added Lead in Petrol was adopted in 1998 at the Fourth Ministerial Conference "Environment for Europe". The significant changes in the temporal and

Figure 15: Atmospheric emissions of lead in Europe in 1980 (left), 1990 (middle) and 2000 (right) (in kg km^{-2} $year^{-1}$)



Source: (EMEP 2007a)

Table 5: Sulphur contents for road transport fuels in some SEE countries

Country	Petrol sulphur content (ppm)	Diesel sulphur content (ppm)
EU Directive 1999/32 + 2003/17	50 (10 in 2009)	
Albania	150 (imported)	350 (imported), 2000 (national production)
Bosnia and Herzegovina	150	350
Croatia	50	50
Serbia	650–1000 (depending on grade)	350–10,000 (depending on grade)

Source: BRRT 2007a

spatial patterns of lead emissions from 1980 to 2000 largely reflect the substantial reductions in use of gasoline lead additives. It is evident that these changes in emissions have also had a marked impact on the transboundary air pollution of lead in Europe during the same period, as shown in figure 15 (EMEP 2007a).

Lead was eliminated from gasoline in the Russian Federation (although the use of MMT[19], also problematic, is widespread). Georgia has developed a strategy to phase out leaded fuels, including an awareness raising component (1998–2000). Armenia has conducted research on introducing cleaner fuels, including the phasing-out of leaded petrol. Kazakhstan has developed national requirements for the introduction of lead-free petrol.

In general, the lead phase-out in EECCA and SEE is ongoing, but as of 2007, leaded fuel had not been banned in Bosnia and Herzegovina, Montenegro, Serbia, Tajikistan or Turkmenistan (BRRT 2007c and OECD 2007). In addition, there may be a significant black market for leaded fuel in some countries (e.g. Georgia) and some reluctance to phase out lead completely because of its continued use in some older vehicles. Lead emissions are decreasing at a slower than expected rate. In addition to affecting health, lead destroys the effectiveness of catalytic converters, hence obstructing the introduction of cleaner technology (BRRT 2007c and OECD 2007).

Sulphur

Since 1980, action has been taken in a number of mainly western European countries to decrease air pollution from sulphur, with the greatest efforts being made in Northern Europe, in the countries where the effects of acidification were most severe. A sharp decrease in sulphur emissions has been seen in Eastern European countries from 1990, largely as a result of the effects of the economic recession in Eastern European economies (EMEP 2007b).

The sulphur content of diesel fuel is important; low-sulphur diesel is available and attractively priced in only a few countries in EECCA and SEE. Most EECCA countries follow GOST[20] standards that set maximum sulphur content for diesel at 2000 ppm and 1000 ppm for petrol. Belarus, in contrast, has set sulphur content at 350 ppm for diesel and 500 ppm for petrol. In 2002, 75 per cent of the petrol produced in the Russian Federation had sulphur levels below 500 ppm (500 ppm is the standard for petrol), whereas the diesel fuel had 1000 to 2000 ppm sulphur. In 2006, share of the petrol market with sulphur content lower than 500 ppm was more than 85 per cent, with about 10 per cent EURO 3 petrol and 12 per cent share of EURO 3 and EURO 4 diesel fuels. A new technical regulation which foresees conversion of production to EURO 3 fuels from 1 January 2009 and to EURO 4 from 1 January 2010 will be introduced in 2008 in the Russian Federation.

Table 5 above shows fuel sulphur contents from selected SEE countries, with sulphur levels generally slightly better than EECCA but still far from EU Directive standards. It should be noted that catalytic converters require low-sulphur fuels.

Fuel quality, vehicle emissions, and vehicle inspections

In EECCA and SEE, poor overall quality fuel and few environmental modifications such as catalytic converters make for high environmental impacts per unit of passenger and freight transport, but there are signs of progress. For instance, as of 2002, the former Yugoslav Republic of Macedonia had established a national transport environmental action plan and introduced gas as a fuel for public transport vehicles. Georgia developed a long-term programme to establish an environmentally sound motor vehicle fleet, including improvements in fuel-quality standards (2000–2005).

EECCA and SEE have their own car industries and Western Europe's vehicle technology (e.g. catalytic converters) will not automatically be adopted, but some EECCA and SEE countries have taken up UNECE emission regulations (see table 6 below).

The adoption of EURO vehicle emission norms by the Russian Federation and Ukraine affects more than 70 per cent of EECCA vehicle fleet. Given that most manufacturers will produce to the new standard, this will improve the situation via exports to countries that have not introduced the standards (Walsh 2004). Although most part of the fleet does not meet the latest amendments to the UNECE regulations (standards were harmonized with previous norms of these regulations (EURO 0 level), enforcement of EURO standards will be an issue.

[19] *Methylcyclopentadienyl manganese tricarbonyl.*

[20] *GOST: a set of technical standards maintained by the Euro-Asian Council for Standardization, Metrology and Certification (EASC), a regional standards organization operating under the auspices of CIS.*

Table 6: Adoption of EURO vehicle emission standards by non-EU countries

European Union	1992–1995	1996–2000	2001–2004	2005–2007	2008–20010
Passenger cars/light commercial vehicles	**EURO 1**	**EURO II**	**EURO III**	**EURO IV**	**EURO V**
SEE					
Albania	National limits for CO and HC				
Bosnia and Herzegovina	No regulation				
Croatia *(on new imported vehicles)*			2007	2007	
Montenegro	No regulation				
Serbia	No regulation				
The former Yugoslav Republic of Macedonia	National limits for CO				
EECCA					
Belarus	UNECE regulation				
Kazakhstan	Considering the introduction of EURO norms				
Russian Federation		2006	2008	2010	
Ukraine *(on imported vehicles)*		2005	2008	2010	

Source: as reported by BRRT 2007c

Vehicle emissions testing and inspections help ensure that road vehicles meet environmental standards (including reasonable safety standards). Most EECCA and SEE countries have vehicle inspection programmes, which can consist of annual tests and random roadside checks.

For many years, Russian Federation has had an effective vehicle technical inspection system. In 1997, the country was one of the first signatories of the UNECE Agreement concerning the Adoption of Uniform Conditions for Periodic Inspections of Wheeled Vehicles. The Russian Federation has a national certification system (type approval) for vehicles, emissions, noise and safety. There is also certification system for motor fuels. As of 2002, Croatia and the former Yugoslav Republic of Macedonia were implementing ECO-tests on exhaust emissions from motor vehicles through annual technical inspections. There is evidence however that the inspection and emissions testing system works poorly in certain EECCA (and also, to some extent, in SEE) countries. In practice, inspections are not always systematic and the authorities are often poorly equipped to measure technical vehicle requirements (and fuel quality). In some places (e.g. Tbilisi), vehicle inspection is no longer compulsory (OECD 2007).

The United Nations Environment Programme (UNEP) established the Partnership for Clean Fuels and Vehicles (PCFV) in 2002. PCFV aims to assist developing countries in efforts to reduce vehicular air pollution through promoting cleaner fuels and vehicles, especially the elimination of lead in gasoline and the phasing-down of sulphur in diesel and gasoline fuels. It has supported national activities (especially workshops) related to cleaner fuels and vehicles in Serbia and Bulgaria as well as regional activities for CEE and EECCA, e.g. workshops in Georgia (January 2008), Hungary (2006) and Serbia (at the 2007 Belgrade Ministerial Conference)).

Renewing the vehicle fleet

The removal of old vehicles from the vehicle fleet plays an important role in reducing emission levels. As an example, it was estimated that if all road vehicles conformed with the 2005 EURO 4 norms in France, emissions would decrease by up to 90 per cent (UNECE 2006b). Improved vehicle technology is increasingly available, and is gradually being introduced into the EECCA and SEE markets, albeit with a delay when compared to the EU countries (BRRT 2007c).

Some countries have placed import bans on older vehicles or on vehicles without certain pollution control technology, e.g. Armenia banned the import of cars without catalytic converters on 1 January 2007.

Air-quality monitoring in EECCA and SEE countries

Most EECCA countries still use the MACs and Guiding Safe Exposure Levels for air-quality standards. These health-based standards were established by the former USSR Ministry of Health 30 to 40 years ago, and do not consider the protection of ecosystems. MACs are generally more stringent than the WHO guidelines, except for being laxer for heavy metals and generally non-existent for PM (OECD 2007).

Some EECCA countries have recently updated and supplemented these standards. For instance, the Russian Federation's Ministry of Health approved a health standard in 2003 for 44 substances that cannot be emitted, 625 substances with MACs and 1,945 "tentatively safe exposure levels" for ambient air (OECD 2006). Overall, however, the large number of regulated pollutants and the zero-risk philosophy impose unrealistic monitoring and enforcement requirements on public authorities (UNECE 2006b).

Air-quality monitoring networks in EECCA were generally established in the 1970s and 1980s. Complete monitoring programmes were set up, but in practice most fixed

stations in EECCA have reduced programmes (e.g. three times a day, mainly manual sampling because there are few automated monitors, and only a small number of regulated pollutants being monitored). Measured parameters generally follow a 1983 priority list, including TSP, SO_2, CO, NO_2, formaldehyde, benzo(a)pyrene, fluorides, mercury, hydrogen fluoride, cadmium, nickel, lead, chromium and zinc. Obsolete measuring methods are still widely used, and do not allow population exposure to air pollution to be estimated reliably. Ground-level ozone, PM10 and PM2.5 are generally not measured, with the exception of the Russian Federation and Belarus; as of 2004, the Russian Federation monitored PM10 in Moscow and Saint Petersburg and Belarus had developed a standard for PM10 (as of 2005). Air pollution is acknowledged as a serious problem in EECCA, but the lack of funds and of more health-relevant and high-quality monitoring data has prevented an in-depth assessment of the current situation. A 2005 WHO meeting in Moscow recommended that EECCA countries focus on monitoring PM10 and PM2.5, NOx, SO_2 and ozone, and use WHO Air Quality Guidelines as the background for their policies and standards (BRRT 2007a and Dimitrov 2004). (See *http://www.euro.who.int/Document/AIQ/health_basis_AQ.pdf*)

4.2.2 Transport-related energy use and climate change

The signatories to the United Nations Framework Convention on Climate Change aim to stabilize atmospheric GHG at a level that prevents significant (anthropogenic) interference with the climate system. Global emissions need to be reduced by 50 per cent compared to 1990 to stabilize global CO_2 atmospheric concentrations (UNEP et al 1999 and BRRT 2007b). In support of this objective, the EU has adopted a policy on modal balance, aiming to stabilize the market share of rail. Good progress has been achieved for passenger rail transport by investing in high-speed rail, but the freight rail sector continues to lose market share to road transport. Otherwise, EU technology measures have focused on a voluntary commitment by car manufacturers to produce new passenger cars that emit 140 g/km or less of CO_2 by 2008/2009 (i.e. a reduction of 25% over 10 years).

The aim of these voluntary codes was to encourage manufacturers to move towards them competing on the basis of fuel efficiency instead of size and power. However, the strategy has brought only limited progress towards achieving the target of 120 g CO_2/km by 2012; from 1995 to 2004 average emissions from new cars sold in the EU-15 fell from 186 g CO_2/km to 163 g CO_2/km (EC 2007d). As a result, the European Commission is now moving towards imposing mandatory targets for CO_2 emissions from cars, although there remains some debate about the level at which the targets will be set.

Many EEA countries are projected to have difficulties to meet their Kyoto Protocol commitments. GHG emissions in the EU did fall by about 5 per cent between 1990 and 2004, but increases in transportation overall, and specifically increases in traffic and car size, in part offset technical improvements and decreases from the energy, industry, and agriculture and waste sectors. The EU-15 will have difficulty achieving its 8 per cent of its Kyoto target reduction (from 1990 levels).

All EECCA and SEE countries are Parties to the United Nations Framework Convention on Climate Change. Kazakhstan and Tajikistan are the only two EECCA countries that have not ratified the Kyoto Protocol (OECD 2007). Ukraine and the Russian Federation (which have Kyoto commitments) have committed to stabilize GHG emissions at or below 1990 levels by the period 2008–2012, and both are projected to meet their commitments (mainly due to the economic and structural changes occurring in the 1990s, resulting in lower energy use). Other Central European countries have agreed to keep emissions 8 per cent below the 1990 levels (UNEP et al 1999). Notably, however, emissions in SEE have increased by about 2 per cent (BRRT 2007b).

Progress overall in the UNECE-WHO European Region has been slow, and transport-sector CO_2 emissions have proven difficult to address. Although technological improvements are helping, transport-sector CO_2 emissions are expected to rise in the future due to growth in passenger and freight transport, especially for road and air modes (UNECE/WHO Europe 2004).

4.2.3 Road traffic crashes and injuries

In the EU countries, better enforcement of speed limits, as well as alcohol limits, are among the most effective elements used to reduce fatality rates in spite of substantial growth in transport demand. The use of "demerit points" – where minor breaches are added up and could lead to a revoking of the driving license – has also been effective, as in the Danish example, where such a system was introduced in 2005 and within 12 months the country was able to meet its 2012 traffic safety target. In new EU Member States (e.g. the Czech Republic), the use of demerit points has been less successful (BRRT 2007c).

There has been limited success in implementing measures to better control drunk-driving and excessive (urban) speeds in EECCA and SEE countries, although good practice measures have been integrated into the recent Road Safety Action Plans (e.g. in the Russian Federation National Road Safety Programme 2006-2012).

WHO Europe (2007), using ENHIS, compiled data on the degree of implementation of 10 policies aimed at preventing road traffic injuries in children and young people. The study showed using 2006 data that a number of countries demonstrated a high political commitment (e.g. Portugal and Croatia) for implementing the 10 policies

(e.g. children riding on motorcycles should wear safety helmets), although some policies (e.g. children under the age of 3 should face backwards if seated) were for the most part poorly implemented. In general, there was less commitment to implement the 10 policies in the EECCA and SEE countries surveyed (Albania, Armenia, Georgia, Serbia and Montenegro and Uzbekistan), although there was scope for improvement across the region (WHO Europe 2007).

The apparent difficulty in further reducing road traffic crashes and injuries could indicate the need to develop and implement new preventive strategies (Racioppi et al 2004). This could be supported by the European Commission's European Road Safety Charter, which calls for a halving of road traffic injuries by 2010 (*http://ec.europa.eu/transport/roadsafety/charter/index_en.htm*).

4.2.4 Cycling and walking

Many countries in the region have observed trends towards separate places to live, to work and to spend leisure time, leading to urban sprawl and longer travel distances. This favours motorized mobility and contributes to decreased opportunities for cycling and walking, which are only viable for short trips. In Western Europe, about 30 per cent of car trips are less than 3 km long, with 10 per cent of trips not longer than 1 km.

There has been increasing attention paid to physical activity policy in the last 10 years, with a number of key policies stressing the need to make stronger connections between public health and transport professionals (WHO 2002, WHO 2006, WHO 2006a, EC 2005). Much of the increased recent emphasis on physical activity is linked to concern over rising rates of obesity and non-communicable diseases (WHO 2006 WHO 2006a).

Of particular note during the period 1997–2007 was the development of the first Global Strategy on Diet, Physical Activity and Health (WHO 2004b), which set out a plan to reduce deaths and disease burden worldwide by improving diet and promoting physical activity, including through cycling and walking.

In many countries, the promotion of physical activity is traditionally seen to be the domain of health and sport professionals. There is some indication that transport professionals are increasingly working with health professionals to improve conditions for walking and cycling and to help to build physical activity into part of daily activities. However, this potential still remains largely untapped: in most countries, cycling and walking have generally been marginalized in transport decision-making, which is also reflected by their low share of investment, less than 10 per cent (EC 2000).

A small number of countries, e.g. Denmark and the Netherlands, have implemented successful cycling policies that have clearly increased the levels of cycling, which accounts for a sizable share of daily mobility in these countries (EC 2000b). Other countries, e.g. Austria, have started to follow this lead (Ministry of Agriculture, Forestry, Environment and Water 2006).

Bicycles are starting to be seen as an element in planning more sustainable transport in SEE cities. For instance, as part of a master plan for urban development, Belgrade has embarked on a programme to construct more bicycle paths. New paths for recreational biking are prioritized initially, but the long-term target is to achieve a modal share of 10 per cent, from the current 2 per cent (BRRT 2007c).

4.2.5 Transport-sector noise

It is only relatively recently that road transport regulation has included a focus on noise. The evidence of insufficient national noise emission standards, together with unsustainable trends in noise pollution, indicates gaps in the existing legislation. A holistic and integrated approach to reducing human exposure to noise is lacking at the international level. The monitoring of noise exposure and the exchange of information among Member States are strongly handicapped by the large variety of noise indicators and assessment methods used in the different Member States.

A number of agreements and legal instruments have addressed the issue of noise, focusing on: (a) measurement methods and the mapping of noise-affected areas; (b) reduction measures, including measures for sensitive areas (e.g. near schools) and times (e.g. nights, weekends); and (c) noise emission and/or standards and control measures.

Relevant UNECE, WHO and EU agreements since 1997 include:

- The UNECE Agreement on technical inspections of vehicles[21].
- The WHO Guidelines for Community Noise (2000), which cover community noise in general. These Guidelines contain information on the maximum noise level acceptable for a given activity (such as sleeping or communicating) and leave it to governmental regulatory bodies to establish the complying regulations.
- Regulations on noise emission sources, including directives on permissible sound levels from motor vehicles.

The EU Directive on Environmental Noise, which includes: (a) harmonization of noise indicators and assessment methods; (b) noise mapping; (c) action plans; (d) target-setting for the common noise indicators by Member States; (e) information to the public on noise maps and

[21] *Agreement concerning the Adoption of Uniform Conditions for Periodical Technical Inspections of Wheeled Vehicles and the Reciprocal Recognition of Such Inspections (1997).*

action plans; (f) an EU databank on noise maps and action plans; and (g) provisions for the setting of EU goals on the reduction of the number of noise-affected EU citizens.

4.2.6 Psychological and social effects

As noted in section 3.5, transport-related psychological and social effects are often ignored or underestimated, and as a result, it is difficult to identify specific progress.

Although data are scarce, it is likely that the continuing trend towards greater mobility and increased use of passenger transport has increased community severance, decreased social interaction and possibly increased stress and negatively affected mental health.

Conversely, the general decline in traffic crashes and injuries may have led to positive impacts vis-à-vis the incidence of accident-related psychological conditions, including anxiety and post-traumatic stress disorder. However, fear of traffic still remains high, and there is a significant disincentive to walking and cycling.

An explicit integration of transport-related psychological and social effects into sustainable urban transport policies is needed.

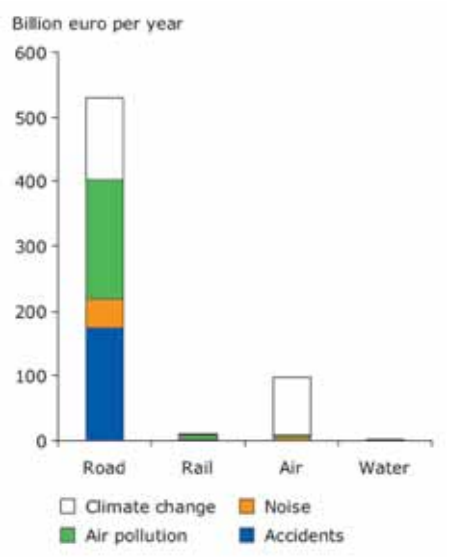
4.3 Demand management and modal shift

4.3.1 Demand management in Western Europe

There have been a number of developments aimed at managing or limiting transport demand in Western Europe. These include EU instruments such as the European Spatial Development Perspective, the EU Transport Strategy of 1999 and the EC Communication "Sustainable Urban Development in the European Union: A Framework for Action" of 1998, and the European Sustainable Cities and Towns Campaign (United Nations Economic and Social Council 2001). Despite these efforts, there has been limited sign of these efforts being translated into declining passenger numbers. The EU White Paper on transport predicted that between 1990 and 2010, road transport will have increased by 50 per cent, with forecasts indicating that this growth will apply to both the overall volume of transport and its intensity in terms of km travelled and tons transported (EC 2001).

Transport demand has outpaced growth in GDP in most EU Member States since the late 1980s, particularly in the freight sector. This trend is likely to accelerate with the accession of new Member States to the EU.

Figure 16: Total external cost of transport in the EU-15 plus Norway and Switzerland in 2000

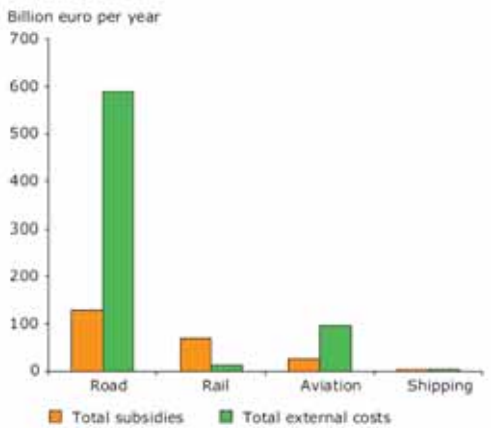


Source: INFRAS/IWW (2004)

4.3.2 Demand management in EECCA and SEE

The period 1997–2007 saw limited progress on transport-sector demand management in EECCA and SEE, specifically regarding implementation of measures to reduce the need to travel through land-use planning, policies and other measures (e.g. new parking policies, road pricing systems and other means to limit car traffic in urban centres, or the use of logistics and telematic systems to reduce vehicle movements and empty runs).

Figure 17: Total external costs and transport subsidies found for EU-15



Source: EEA 2007b

Note: The numbers for subsidies comprise on-budget subsidies, annual public funding or infrastructure and exemptions from or reductions to fuel tax and VAT. The numbers for external costs includes costs of accidents, noise, air pollution, climate change, nature and landscape, up- and downstream processes and additional urban costs.

4.3.3 Land use for transport

Progress in this area is uncertain, as there are no quantitative targets for land take for urban development at the European level, although different documents reflect the need for better planning of urban development and the extension of infrastructure. One key area of required action is the development of urban planning regulations that discourage the development of sprawl and "commuter suburbs" and promote "mixed development", where people are more likely to live closer to their work, shops, leisure areas and schools (ECMT 2007). A structured settlement development policy is a pre-condition to managing traffic growth and CO_2 emissions without restricting the access to services that mobility provides. Planning for mixed development patterns can limit the demand for long, motorized journeys, just as planning for higher-density land-use patterns can favour public transport (ECMT 2007).

Urban sprawl in EECCA and SEE is also the trend, with industries moving to the outskirts of cities and to the countryside. Spatial planning measures to curb such developments have yet to be fully utilized.

4.3.4 Internalizing the costs of transport

4.3.4.1 Progress in Western Europe

The 2001 EU White Paper on transport pointed out that existing transport price structures generally fail to reflect all the costs of infrastructure, congestion, environmental damage and accidents (EC 2001). The situation differs enormously from one Member State and mode to another. This leads to dysfunction in the internal market and distorts competition within the transport system. As a result, there is no real incentive to use the cleanest modes or the least congested networks (EC 2001).

Internalizing the costs of transport relies on placing monetary values on the associated externalities. This is a complicated issue due to the diverse nature of many of the health and environmental impacts (OECD 2006). However, there has been considerable progress made with respect to scientific methods for valuation of transport externalities in recent years (ECMT 2003b).

Figure 16 shows the results of the most recent study on external costs of transport in the EU-15 plus Norway and Switzerland. It takes into account the costs of climate change, air pollution, noise and accidents.

The estimation of total external costs (excluding congestion costs) amounted to €650 billion for 2000, or about 7.3 per cent of the total GDP in the EU-15, Norway and Switzerland. This means that the often stated overall contribution of transport to GDP of 10 per cent is actually much lower when the external costs are taken into account. Climate change accounted for 30 per cent of total costs, with air pollution and accident costs amounting to 27 per cent and 24 per cent, respectively. Noise and life-cycle processes each accounted for 7 per cent of the total costs. The most important contributing mode is clearly road transport, generating 83 per cent of the total cost. Two thirds of the costs are caused by passenger transport and one third by freight transport (OECD 2006).

A critical issue is the scale of the subsidies offered to the transport sector: a study of the EU-15 countries identified subsidies worth €270 to 290 billion a year in 2005. Of this, road transport received €125 billion in annual subsidies, mainly in the form of infrastructure subsidies; aviation was subsidized mainly via preferential tax treatment (exemptions from fuel tax and VAT) with €27 to 35 billion; and rail received €73 billion in infrastructure- and fare-reduction subsidies. Waterborne transport received €14 to 30 billion (EEA 2007a).

These transport subsidies:

- Influence the environmental performance of vehicles (e.g. encouraging the use of one type of fuel over another)
- Affect transport management decisions (e.g. with regard to load factors, route planning and/or fleet composition)
- Stimulate a modal shift from or to less environmentally friendly transport modes (e.g. subsidies can change the competitiveness of a particular transport mode)
- Induce additional transport demand (e.g. subsidies lowering the costs of transport lead to increases in the number of trips and their distances) (EEA 2007a).

Figure 17 shows transport subsidies alongside estimated external costs (EEA 2007b). However, it is important to note that this approach ignores the large amount of taxes paid by the transport sector, so significantly lower estimates of road subsidies are equally plausible.

ECMT stated that in 2003 a pricing and charging system which was clearly and fairly related to the value of infrastructure and external costs caused by its use was "many years" away (ECMT 2003a). However, the main reason for using these measures is generally seen to be to collect resources for the Treasury and for the development of infrastructure rather than to control transport demand. Opposition to simple forms of pricing (e.g. parking charges) has shown that wide application of pricing will be extremely difficult. Progress in this area depends on how successful the European Commission will be in introducing the "user-pays principle" (ECMT 2003b). There are some interesting case studies in the experiences of the congestion charges introduced in London and Stockholm. In both cities, the measure was unpopular when introduced, but has since come to be seen by the majority of inhabitants as a positive development. The London charge zone is now being

Table 7: Relative efficiency (before implementation costs) of different pricing instruments in the case of Brussels, 2005

Policy	Relative economic efficiency (percentage)
Benchmark (unchanged policies)	0
Higher fuel taxes	5
Better public transport pricing	5–10
Parking charges	30
Cordon pricing	52
Full social marginal cost pricing	100

Source: Proost 2002

extended, and the Stockholm scheme was approved in a public vote. This shows that initially unpopular measures can become more acceptable over time, following practical experience.

Table 7 shows an estimate of the relative economic efficiency of different pricing instruments, using the example of Brussels (Proost 2002). The table shows the share of the maximal welfare gains one could potentially achieve from various policies, and that higher fuel taxes are relatively inefficient when compared to charges for infrastructure use, e.g. parking charges or cordon pricing.

In a small number of countries (Belgium, Denmark Germany, Luxembourg the Netherlands, and Sweden), the "Eurovignette" system tested the approach of charging heavy-goods vehicles an annual charge according to the damage they cause to the environment and roads. Charges are based on emissions (the EURO standard) and the size of the vehicle (number of axles), and range from €750 to 1550 per year. Although the charges are not linked to distance travelled, this system does go some way towards the principle of fair and efficient pricing (i.e. external costs should be paid in full by users) (EC 2001).

Also of great relevance has been the rise in fuel prices in recent years. In the course of the 1990s, taxes on fuels had been increased by 6 points over the rate of inflation every year. Current motor fuel prices include a 200 to 300 per cent tax, so significant rises in fuel tax are often unpopular measures, and may not lead to the desired level of change. For example, it takes a 10 per cent increase in fuel prices in real terms to produce a 1.5 per cent reduction in traffic levels within the first year, which might build up to about 3 per cent reduction after five years, but only if the price increases are sustained. It is likely that there are cheaper and more effective options for GHG emissions reductions in other sectors (ECMT 2003b).

4.3.4.2 Progress in EECCA and SEE

The gap between subsidies and external costs and variable charges is also high in EECCA because of higher external costs and the lack of effective economic instruments (i.e. tax differentiation). In some EECCA countries, fuel prices are insufficient to cover road maintenance and construction. The use of budgetary revenues from collected fuel taxes for road infrastructure and maintenance also varies among the EECCA countries. In some countries, fuel is subsidized, e.g. diesel fuel in Azerbaijan and all fuel in Turkmenistan is sold below the world market price (OECD 2007).

In 1995, the external costs of transport as a percentage of GDP were estimated as 16 per cent in Belarus, 17 per cent in Ukraine and 14 per cent in the Republic of Moldova, and the annual loss related to road crashes and road traffic injuries, transport-related air emissions, and traffic congestion in Russian cities was about 9 to 9.5 per cent of the GDP. (In 2003, the external costs of the Russian motor transport were estimated at 9% of the country's GDP: 48% from crashes, 33% from traffic jams and 19% from air pollution.) In SEE, the external costs are typically 10 per cent of GDP (BRRT 2007c and OECD 2007).

Domestic underpricing of energy is a general issue (OECD 2007). In addition to use of instruments such as road pricing, priorities for most EECCA countries include abolishing fuel subsidies and increasing fuel taxes to self-finance the transport system and to promote efficient energy use. Subsequently, toll charges and the restructuring of the registration and circulation taxes could be implemented (BRRT 2007c, quoting UNECE 2003).

Fuel taxes vary between the EECCA and SEE countries, but generally differentiate between leaded and unleaded petrol and between diesel and gasoline. In the Russian Federation and some other EECCA countries, differentiation is related to gasoline octane grading. (Leaded petrol is prohibited in most of the CIS countries.) OECD (2007) reports that the price differential in absolute terms between gasoline and diesel in EECCA increased from 2002 to 2006, and as such will encourage the consumption of the diesel fuel (more polluting effects of diesel fuels are considerably reduced with the application of modern exhaust cleaning technology). However, in Moscow for example, the price of 1 litre of 95 octane gasoline is only 9 to 11 per cent higher than for diesel fuel. It is not clear what has happened to relative prices in other CIS countries, however, which may play a greater role in consumer choice.

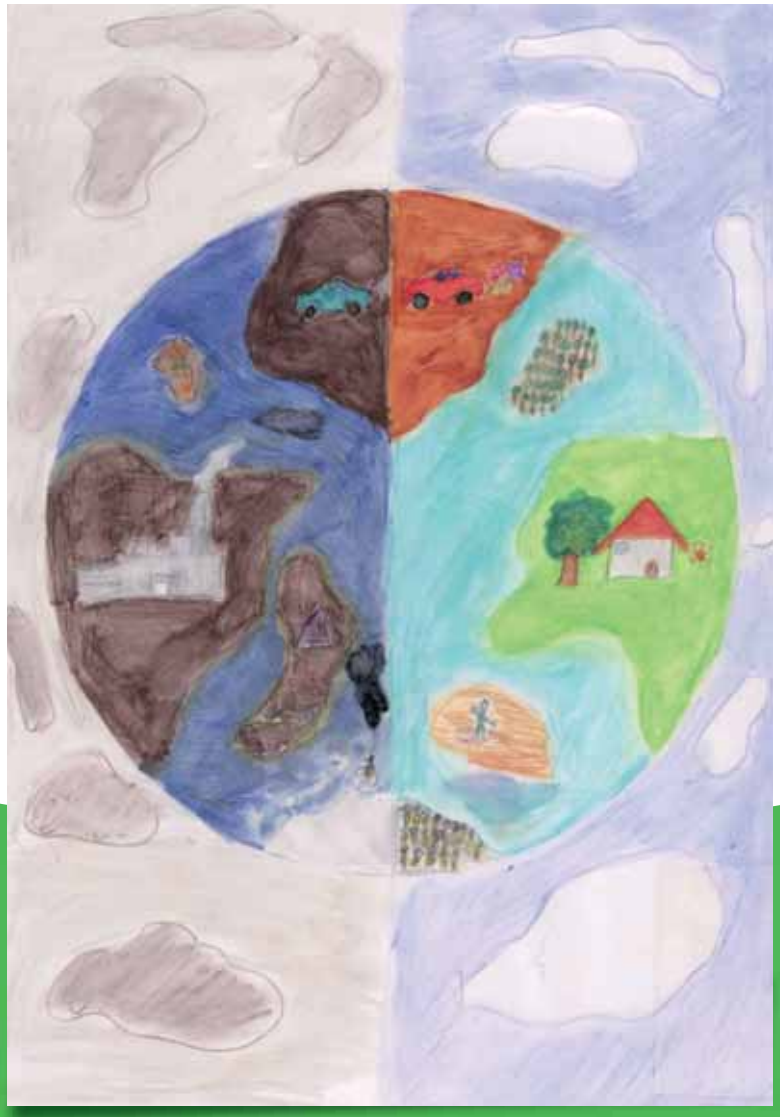
There are taxes on imported cars, vehicle registration taxes, and excise and value-added taxes on fuel. Vehicle owners have to pay an annual property tax and service charge for preventive maintenance. In general, freight vehicles pay transport taxes based on weight and the degree of hazardousness (BRRT 2007c quoting OECD 2003).

Current car import taxes are not always consistent with environmental objectives. For instance, cars less than 3 years old in Belarus have higher import tax rates than those between 3 to 10 years old. Import taxes in Georgia (as well as annual vehicle taxes) decrease with vehicle age (OECD 2007).

Economic instruments are generally fiscal in nature. There is a need to shift the use of economic instruments from a fiscal to an incentive function, with rates that have an environment-driven differentiation (i.e. to change behaviour). There has been limited progress to date on using economic and fiscal measures to stimulate sustainable transport (i.e. little progress has been made vis-à-vis implementing measures such as congestion pricing, road pricing, parking policies, variable costs differentiated fuel and vehicle taxes according to emission levels, and fuel consumption and quality).

In the Russian Federation (and elsewhere in EECCA), the economic mechanisms in use are generally coercive tools: environmental charges and taxes cover a large number of air and water pollutants, and there are fines for environmental offences and claims for environmental damage. Pollution charges in the Russian Federation are levied on all "nature users" subject to environmental permits. They are imposed for 214 air pollutants, but for mobile sources, only enterprise-owned transport vehicles are charged for air pollution. Private cars are excluded. The revenues from pollution charges (effective Jan. 2006) are distributed as follows: 20 per cent to the federal budget; 40 per cent to the regional budget; and 40 per cent to the local budget) (OECD 2006).

In general, there has been little progress made on abolishing market distortions that favour the transport modes responsible for the majority of external costs. No progress has been made vis-à-vis introducing instruments to stimulate the shift of road and short-haul air traffic to more environmentally friendly modes (e.g. to rail and inland waterways). It should be noted that, in contrast to Western Europe and SEE where rail transport is in decline, in EECCA countries (and in the Russian Federation in particular) railways share is about 90 per cent of the total freight transport turnover. The Russian model needs to be further assessed to determine its level of good practice and to ensure that the share of rail freight and rail passengers is sustained over time. This has been already done to a considerable extent in the OECD regulatory reviews.



Kar-Fritz Scheufele (grade 6R)

5 - Conclusions

This report aimed to review developments and progress in transport health and environment across Europe since 1997. It demonstrates that transportation is an integral part of economic and social development and essential to the functioning of modern societies. However, it has also shown that current patterns of transport and travel are not sustainable given the increasing pressures, in particular on urban areas. These include the negative effects on health and ecosystems of transport-related air pollution, congestion and road traffic accidents.

Trends over the past 10 years point to the need for innovative solutions addressing the challenges of sustainability, accessibility, mobility and making cities more liveable. This requires a strengthened and sustained commitment from Governments at both the national and local levels as well as a renewed political impetus for change.

While motorized transport has continued to increase rapidly in the EU over the last decade, freight transport is growing faster than passenger transport. Under a "business as usual" scenario, forecasts indicate that this trend will continue through 2020. In the new EU Member States, there has been a shift from public transport to private road transport in recent years. The ongoing dominance of road transport and the increase in air transport is likely to continue.

In the EECCA and SEE, passenger transport is rising again since economic recovery in the late 1990s. Rail and bus/coach transport remain the most important means of passenger transport. The share of passenger car transport is limited in EECCA (and to some extent in SEE), but private motorization is increasing. Because car ownership is strongly correlated with GDP, it is expected that the passenger vehicle fleet will grow along with the economy in the coming decades. At the same time, public urban transport systems in EECCA require improvements and investments.

In view of these strong pressures from economic growth and changing markets, there is a great need to integrate the principles of sustainable development into transport policies. These include system elements that best protect health, conserve resources, are energy efficient, consume the least land, have the lowest externalities, are socially acceptable and are the safest.

This further requires a shift in policymakers' attitudes and also one in practice in order to meet the challenge of reducing the negative consequences of current transport patterns on the environment and the health of populations while at the same time preserving the social and economic benefits. If policymakers want to achieve an impact on sustainable transport and mobility, cooperation among the transport, health and environment sectors is imperative. In this context, THE PEP represents a unique policy platform aimed to promote enhanced cooperation among the three sectors and to provide an international framework for implementation at the national and local levels. The challenge however remains to develop institutional arrangements and the necessary commitment by Governments to adopt an intersectoral approach to policymaking.

Interested readers are directed to an accompanying publication, THE PEP Assessment Report. This reviews progress made in the three priorities of THE PEP (integration of environment and health into transport policies, sustainable urban transport, and demand-side management and modal shift, and) as well as on cross-cutting issues (e.g. ecologically sensitive areas and particular needs of EECCA and SEE countries). THE PEP Assessment Report highlights a number of recommendations for THE PEP programme and Member States, and provides concrete guidance for future action.

James Francis (grade 6R)

Annex I

Area, population density, and gross domestic product per capita of countries in the European Union-27

	Area (km²)	Population 2003 (in thousands)	Density (persons per km²) (2003)	GDP/capita in 2005 (at prices and PPP* of 2000 United States dollars)
EU-27				
Austria	83,858	8,236	98	30,058
Belgium	30,528	10,421	341	28,036
Bulgaria	110,913	7,781	70	8,129
Cyprus	9,251	739	80	20,125
Czech Republic	78,866	10,216	130	17,778
Denmark	43,094	5,419	126	30,338
Estonia	45,228	1,346	30	14,561
Finland	338,150	5,246	16	29,119
France	551,500	62,702	114	27,036
Germany	357,030	82,469	231	26,293
Greece	131,957	11,103	84	20,321
Hungary	93,030	10,087	108	15,426
Ireland	70,273	4,159	59	34,062
Italy	301,337	58,175	193	25,992
Latvia	64,589	2,300	36	12,309
Lithuania	65,300	3,414	52	12,917
Luxembourg	2,586	457	177	56,768
Malta	316	403	1277	17,602
Netherlands	41,526	16,319	393	29,366
Poland	312,685	38,182	122	12,432
Portugal	91,982	10,549	115	18,357
Romania	238,391	21,684	91	7,765
Slovakia	49,012	5,387	110	13,595
Slovenia	20,253	2,000	99	19,587
Spain	505,992	43,398	86	22,931
Sweden	449,964	9,029	20	29,991
United Kingdom	242,910	60,266	248	28,247
Norway	323,759	4,623	14	39,020
Switzerland	41,285	7,437	180	30,935

Source: http://www.unece.org/stats/profiles2007/ (accessed 6 November 2007)

* Purchasing power parity.

Marina Popovich (grade 6G)

Annex II

Area, population, density and gross domestic product per capita of countries in South-Eastern Europe and Eastern Europe, Caucasus and Central Asia

	Area (km²)	Population 2003 (thousands)	Density (persons per km²) (2003)	GDP per capita in 2005 (at prices and PPP* of 2000 United States dollars)
SEE				
Albania	28,748	3,103	108	4,792
Bosnia and Herzegovina	51,197	2,844	56	7,077
Croatia	56,542	4,441	79	11,760
Montenegro and Serbia	102,173	8,148	80	4,899
The former Yugoslav Republic of Macedonia*	25,333	2,039	79	6,416
EECCA				**7,186**
Armenia	29,743	3,212	108	4,422
Azerbaijan	86,600	8,266	95	4,374
Belarus	207,600	9,849	47	6,906
Georgia	69,700	4,315	62	3,362
Kazakhstan	2,724,900	14,951	5	6,927
Kyrgyzstan	199,900	5,012	25	1,695
Republic of Moldova	33,845	3,616	107	2,151
Russian Federation	17,075,400	144,168	8	9,584
Tajikistan	143,100	7,320	45	1,134
Turkmenistan	488,100	5,110	9.9	5,067
Ukraine	603,700	47,442	79	6,193
Uzbekistan	447,400	26,593	59	2,283

Source: http://www.unece.org/stats/profiles2007/ (accessed 6 November 2007)

* Purchasing power parity.

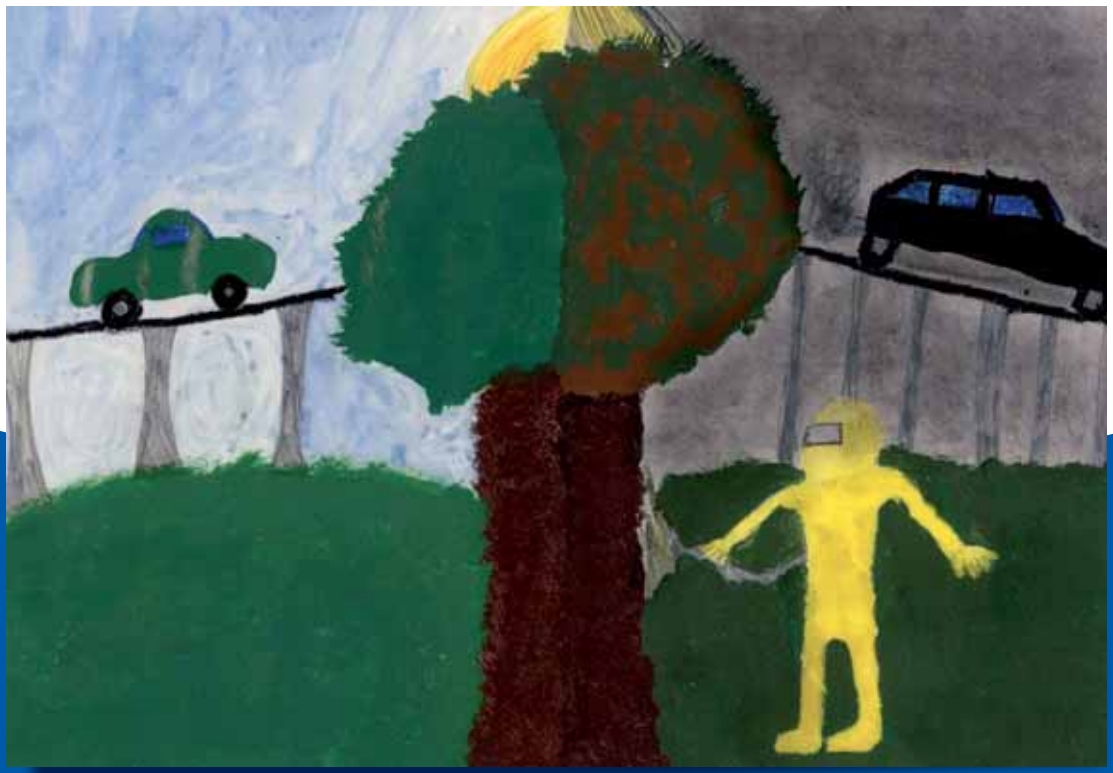
Mehreen Ali Khan (grade 60)

Annex III

Principal pollutants and their sources in transport

Pollutant	Significance
Lead	Lead retards the intellectual development of children and adversely affects their behaviour. At high levels, it increases incidence of miscarriages in women, impairs renal function and increases blood pressure. More lead is absorbed when dietary intake of calcium or iron is low, when the stomach is empty, and by children. Young and poor malnourished children are therefore particularly susceptible to lead poisoning. Lead emissions in transport are entirely from the use of leaded gasoline.
Particulate matter	The health effects of exposure to PM include chronic bronchitis, asthma attacks and other forms of respiratory illness, and premature death from heart and lung disease. Diesel-fueled and two-stroke engine gasoline vehicles are two significant sources of PM emissions.
Sulphur dioxide	SO_2 causes changes in lung function in persons with asthma and exacerbates respiratory symptoms in sensitive individuals. SO_2 also contributes to acid rain and to the formation of small particles, called secondary particulates, through atmospheric reactions. The amount of SO_2 emitted is directly proportional to the amount of sulphur in the fuel. Sulphur occurs naturally in crude oil and consequently is found in both gasoline and diesel fuel unless it has been removed.
Nitrogen dioxide	NO_2 causes changes in lung function in persons with asthma, contributes to acid rain and secondary particulate formation, and is a precursor of ground-level ozone. Vehicles emit nitric oxide (NO) and NO_2, which are jointly referred to as NO_x. NOx is formed in high-temperature combustion, mainly from air in the combustion chamber.
Ozone	Ozone, the main chemical in photochemical smog, has been associated with lung function decrements, asthma attacks, other forms of respiratory illness and premature death. Ozone is not emitted directly, but is a secondary pollutant formed in the atmosphere through photochemical reactions of NOx and volatile organic compounds.
Carbon monoxide	CO inhibits the capacity of blood to carry oxygen to organs and tissues. People with chronic heart disease may experience chest pain when CO levels are high. At very high levels, CO impairs vision, manual dexterity and learning ability, and can cause death. The majority of CO emissions in transport are from gasoline-fuelled vehicles.

Source: World Bank 2005



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Annex IV

Status of ratification of the Protocols of the Convention on Long-range Transboundary Air Pollution in Eastern Europe, Caucasus and Central Asia and South-Eastern Europe

Country	Convention	EMEP Protocol[a]	1985 Sulphur Protocol[b]	NOx Protocol[c]	VOCs Protocol[d]	1994 Sulphur Protocol[e]	Heavy Metals Protocol[f]	POPs Protocol[g]	Gothenburg Protocol[h]
EECCA									
Armenia	1997						signed	signed	signed
Azerbaijan	2002								
Belarus	1980	1985	1986	1989					
Georgia	1999								
Kazakhstan	2001								
Kyrgyzstan	2000								
Republic of Moldova	1995						2002	2002	signed
Russian Federation	1980	1985	1986	1989		signed			
Tajikistan									
Turkmenistan									
Ukraine	1980	1985	1986	1989	signed	signed	signed	signed	
Uzbekistan									
SEE									
Albania	2005								
Bulgaria	1981				1998		2003	2001	2005
Bosnia and Herzegovina	1992	1992							
Croatia	1992	1992				1999	2007	2007	signed
Montenegro	2006	2006							
Serbia	2001	2001							
The former Yugoslav Republic of Macedonia	1997								

Source: BRRT 2007a, OECD 2007 and UNECE 2007a

[a] 1984 Geneva Protocol on Long-term Financing of the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe.

[b] the 1985 Helsinki Protocol on the Reduction of Sulphur Emissions or their Transboundary Fluxes by at least 30 per cent.

[c] 1988 Sofia Protocol concerning the Control of Emissions of Nitrogen Oxides or their Transboundary Fluxes.

[d] 1991 Geneva Protocol concerning the Control of Emissions of Volatile Organic Compounds or their Transboundary Fluxes.

[e] 1994 Oslo Protocol on Further Reduction of Sulphur Emissions.

[f] 1998 Aarhus Protocol on Heavy Metals.

[g] 1998 Aarhus Protocol on Persistent Organic Pollutants.

[h] 1999 Gothenburg Protocol to Abate Acidification, Eutrophication and Ground-level Ozone.

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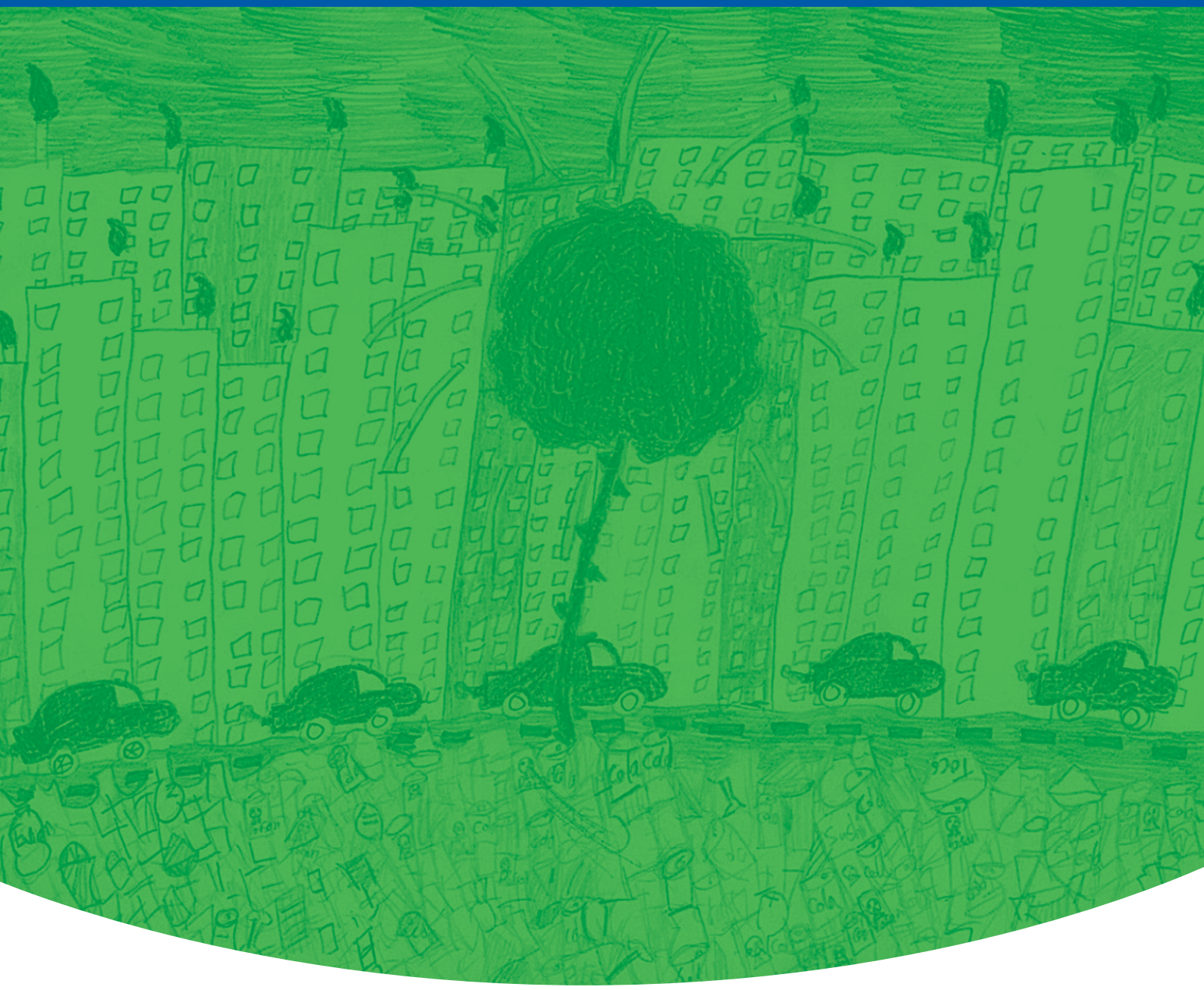

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