

## TRANSPORT INFLUENCE ON SUSTAINABLE DEVELOPMENT

Sebastian Kot<sup>1</sup>, Bogdan Marczyk<sup>2</sup>

<sup>1</sup>*Czestochowa University of Technology, Poland*

<sup>2</sup>*Regional Road Traffic Center Katowice, Poland*

**Abstract:** Transport is an activity with strong impact on environment and human life. Therefore it is very important to discuss possibility of sustainable development of transport. In the paper following areas of transport impact are considered: energy and mineral resources, land resources, water resources, air quality, solid waste, biodiversity, noise and vibration, built environment impacts and health effects.

**Keywords:** transport, sustainable development

Transport is one of the largest sources of environmental pollution in Europe. The large number of significant environmental impacts associated with transport range from local through to global and cut across a large range of issues. Many of these impacts are increasing. Others are beginning to decrease but these impacts may start to increase again in the longer term unless action is taken to reduce transport growth. The environmental impacts associated with transport include energy and mineral resources, land resources, water resources, air quality, solid waste, biodiversity, noise and vibration, built environment impacts and health effects. Impacts across these categories are outlined below. Having outlined the environmental impacts of transport, the importance of establishing policy targets is discussed. Targets can help focus effective action to reduce the environmental impact of transport. These targets should be challenging, but not unrealistic, and they should be amenable to measurement, monitoring, and adjustment over time. It shows that reducing the environmental impacts of transport requires action not just in terms of transport policy, but also in terms of the organization and structure of the transport sector as well as general economic policies.

*Energy and mineral resources.* In 1970, the transport sector accounted for 14 per cent of Europe's energy consumption. By 1995, it was responsible for more than 21 per cent. Energy equivalent to 285 million tonnes of oil was consumed by the transport sector in 1995. In 2006 transport sector was responsible for consumption of 370 million tonnes of oil that means 31 per cent of all consumption [1]. The transport sector is now the largest and fastest increasing consumer of energy due mainly to the growth in road and air transport. The last decade saw large increases in the use of energy intensive modes such as cars and aircraft for the movement of passengers and freight. Over the same period there was a decrease in the use of energy efficient modes such as walking and cycling. Passenger vehicles became more fuel efficient but factors such as catalytic converters, higher safety standards, air conditioning and higher vehicle performance tended to counter the fuel efficiency gains from improved engine design.

*Land resources.* Transport occupies substantial areas of land and the amount of land used for transport infrastructure currently probably amounts to over 20,000 hectares per year (approximately equivalent in area to a square whose sides measure 14 kilometers). Roads occupy approximately one-fifth of the urban surface area and railways take up around a further four per cent of the surface of large cities. Every kilometer of three-lane motorway requires 4.2 hectares of land [2]. In addition to the land consumed for roads, significant amounts are also used for the storage of vehicles. The effects of this land loss include the loss of productive agricultural areas, the loss of biodiversity, and the fragmentation and severance of local communities.

*Water resources.* Transport accounts for much of the consumption of petroleum products and must therefore bear a large part of the responsibility for oil spills in coastal and marine waters. The oil spill from the Sea Empress in February 1996 off the coast of Milford Haven is a recent example of a major water pollution incident with serious impacts on biodiversity, recreation and tourism. 72,000 tonnes of crude oil were released into the sea, of which between 3000 and 5000 tonnes reached the shore, affecting 200 kilometers of shoreline in the United Kingdom.

*Air quality.* Transport produces a number of emissions that are detrimental to air quality. These include global pollutants (such as carbon dioxide which contributes to global warming), national or regional pollutants (for example nitrogen oxides which produce acidification or 'acid rain') and local pollutants (such as particulates which contribute to respiratory problems including the increased susceptibility to asthma). Transport's contribution to environmental pollution in urban areas is particularly large, where transport is by far the most significant contributor of most emissions. The temporal trends in air pollutants from transport are mixed. Some emissions continue to increase, others are beginning to fall. However, some of the emissions that are decreasing may be a problem in the future if the growth in transport increases faster than improvements in technology [3].

Transport is responsible for 21 % of total greenhouse gas (GHG) emissions in EU-15 (excluding international aviation and maritime transport). From 1990 to 2004, EU-15 greenhouse gas emissions decreased in most sectors, particularly energy supply, industry, agriculture and waste management. During the same period, emissions from domestic transport increased by approximately 26 %. Even with all planned reduction measures included transport GHG emissions are projected to grow slightly.

The growth in GHG emissions and energy use in the transport sector is the result of increased transport volumes. Road transport is by far the biggest transport emission source (93 % share). Emissions have increased continuously both for passenger transport (increase of 27 % between 1990 and 2004) and for freight transport (increase of 51 % between 1990 and 2003).

Despite reduced road transport exhaust emissions across Europe, there have been no significant improvements in concentrations of PM<sub>10</sub> and nitrogen dioxide (NO<sub>2</sub>). As exhaust emissions decline, tyre and brake wear are making a growing contribution to total road transport emissions of air pollutants. For example in the United Kingdom this contribution has increased from 15 % in 1990 to 42 % in 2006 [4]. Although NO<sub>x</sub> emissions are declining due to reduced exhaust emission limits, nitrogen dioxide (NO<sub>2</sub>) concentrations are relatively stable. This may be due to an increase in the proportion of NO<sub>x</sub> emitted as NO<sub>2</sub> by vehicles (primary NO<sub>2</sub> emissions), the result of increased sales of Euro 3 diesel vehicles fitted with oxidation catalysts and the fitting of catalytically regenerative particle traps to heavy goods vehicles [5]. These technologies can produce excess NO<sub>2</sub> as a by-product.

In addition to measures that reduce road transport demand in particularly sensitive areas, the 'Euro' exhaust emission standards for all new vehicles are the main tool to reduce vehicle

emissions of regulated air pollutants. The Euro 5 standard for light duty vehicles has now been agreed for September 2009 and Euro 6 for January 2014. Euro 5 is expected to reduce particulate emissions from diesel cars by 80 % compared to Euro 4 (EC, 2007d). The Euro 6 standard should include a method for regulating particle number and should significantly reduce NO<sub>x</sub> from diesel cars. For heavy duty vehicles, the Euro V standard came

*Solid waste* Transport accounts for a significant proportion of solid waste due to the high rate of vehicle scrappage. Millions of road vehicles are scrapped annually, resulting in millions of tonnes of waste material requiring recycling, reclamation and disposal. Vehicle residues for disposal are rapidly increasing as the proportion of steel used in vehicles declines. Plastics are increasingly being used in vehicle manufacture but few of these are recycled at present. Waste tires present another major solid waste problem: millions of tires are scrapped each year.

*Biodiversity* Infrastructure construction and maintenance often leads to losses of vegetation-rich land including hedgerows and verges. Newly planted verges are generally not an adequate replacement. Where new infrastructure cuts across natural or semi-natural habitat, the effects on biodiversity will depend on factors such as the habitat's sensitivity, the siting of the infrastructure and the area of land used for construction. Transport infrastructure such as roads, airports or railways may act as a barrier to the movement of species which may result in the separation of populations and a decline in numbers. Rarer species may disappear if the population becomes too small.

*Noise and vibration* EU Member States reported standardized noise data in a structured way for the first time in 2007, following the adoption of the Environmental Noise Directive in 2002. As a result, it is now possible to start looking at noise exposure across Europe.

In the 1970s it was established that many Europeans suffered ill health due to high noise levels, especially around roads and airports but also near railways and other local sources not necessarily related to transport. A number of local and national investigations were carried out and most of them showed that it would be quite a challenge, not least economically, to achieve the noise limits recommended by the WHO to protect human health.

Since then some emissions reduction measures have been implemented, including building noise barriers and improving window insulation. It is obvious, however, that increasing transport activities have exacerbated noise problems. One contributing reason is that during the late 1970s and 1980s public focus shifted towards the air pollution produced by transport, while noise more or less disappeared from the agenda.

Transport is the most pervasive source of noise for many people in Europe. It is estimated that around 80 million people (or 17 per cent of the population) in Europe are exposed to noise levels above 65 dB(A), which the OECD defines as an unacceptable noise level. The exposure to noise varies by country: from around 4 per cent of the population in the Netherlands to 23 per cent of the population in Spain. The most common sources of transport noise (in order of importance) are road traffic, aircraft and trains. Road traffic is generally considered to be more of a nuisance than most other sources of noise. Conclusive evidence of the health effects of noise is limited to eases of hearing loss and tinnitus caused by long periods of exposure to high noise levels - more than 75-80 dB(A) [6]. It is unlikely that most people are exposed to traffic noise at these levels over a sufficiently long period to cause these health effects, although traffic noise may aggravate or contribute to stress-related health problems such as raised blood pressure and minor psychiatric illness. In addition, transport movement causes vibration which may be another contributory factor to stress-related diseases. Excessive noise from traffic may also discourage social interaction in streets and reduce the attractiveness of walking or cycling.

*Built environment* Transport's impact on the built environment includes the damage to property as a result of accidents, structural damage to transport infrastructure (such as road surfaces and bridges) and damage to property and monuments as a consequence of corrosive local pollutants. Road damage is dependent on factors such as climate, the road surface and the axle weight of vehicles using the road. Because road damage is related exponentially with axle weight, heavy vehicles with few axles cause most of the damage.

*Health effects.* The road transport is the most dangerous of all means of transport, because it has the biggest death rate. Plane or rail crashes with hundred of victims are difficult to accept in our society, but motor transport with its tragic consequences and victims seem to be minor. In the other hand we can't compare road danger with danger in air transport, because everyday on all European roads die as many people as in one medium size passenger plane crash.

1.7 million people were killed in car accidents in Europe since 1970, in year 2006 42,953 people died on European Union roads. Car accidents are also the main reason of death of young people aged between 14 and 25 years old. It is estimated that every third citizen has been injured in any car accident in their life. Direct expenses of road accidents are estimated on the sum of 45 milliard Euro per year, indirect expenses contain physical and mental losses of accidents' victims and their families are estimated on the sum of 160 milliard Euro [7].

Statistics for European Union member countries show the number of people killed in road accidents has been systematically decreasing and in some countries like Germany or Holland the death rate in road accidents decreased more than four times in 2006, comparing with results in 1970, in other 15 member countries of European Union it has decreased a little less, but important.

## References

- [1.] **EU Energy and Transport in Figures.** Office for the Official Publications of the European communities. Luxembourg 2009
- [2.] BANISTER D.: **Introduction: transport policy and the environment.** in BANISTER D. (ed.) *Transport Policy and the Environment.* Spon Press, London 1998.
- [3.] BANISTER D., STEAD D., STEEN P., AKERMAN J., DREBORG K., NIJKAMP P., SCHLEICHER-TAPPESER R.: **European Transport Policy and Sustainable Mobility.** Spon Press, London 2000.
- [4.] **National Atmospheric Emissions Inventory** NAEI, 2009.
- [5.] **Trends in primary nitrogen dioxide concentrations in the UK.** AQEG, Air Quality Expert Group. Defra Publications, London 2007.
- [6.] **Transport and environment: on the way to a new common transport policy,** TERM 2006: indicators tracking transport and environment in the European Union. EEA Report. No 1/2007 European Environment Agency. Copenhagen 2007
- [7.] HEDKVIST PETERSEN E.: **Priorities in EU Road safety** – Progress report and ranking of action. The European Parliament, the Economic and Social Committee and the committee of the Regions COM (2000)125 – C5 0248/2000