ENVIRONMENTAL IMPACT OF LAND TRANSPORT

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Abstract

The development of transport networks has played an essential role in the economic development in all countries. Emissions from road transport vehicles are a major contributor to greenhouse gases and are suspected to be linked to respiratory problems and diseases. The environmental impact of transport is important because it is a major user of energy, and burns most of the world's petroleum. This creates air pollution and it is a significant contributor to global warming through emission of carbon dioxide. Other environmental impacts of transport systems are traffic congestion, acid rain, smog and climate change. This article discusses the environmental impacts of land transport

Key words: Transport, Pollution, Emission, Noise

INTRODUCTION

The issue of transportation and the environment is paradoxical in nature. From one side, transportation activities support increasing mobility demands for passengers and freight, and this ranging from urban areas to international trade. On the other side, transport activities have resulted in growing levels of motorization and congestion. As a result, the transportation sector is becoming increasingly linked to environmental problems. With a technology relying heavily on the combustion of hydrocarbons, notably with the internal combustion engine, the impacts of transportation over environmental systems has increased with motorization. This has reached a point where transportation activities are a dominant factor behind the emission of most pollutants and thus their impacts on the environment. These impacts, like all environmental impacts, can fall within three categories:

- Direct impacts: The immediate consequence of transport activities on the environment where the cause and effect relationship is generally clear and well understood.
- Indirect impacts: The secondary effects of transport activities on environmental systems. They are often of higher consequence than direct impacts, but the involved relationships are often misunderstood and difficult to establish.
- Cumulative impacts: The additive, multiplicative or synergetic consequences of transport activities. They take into account of the varied effects of direct and indirect impacts on an ecosystem, which are often unpredicted.

The complexities of the problems have led to much controversy in environmental policy and in the role of transportation. The transportation sector is often subsidized by the public sector, especially through the construction and maintenance of road infrastructure which tend to be free of access. Sometimes, public stakes in transport modes, terminals and infrastructure can be at odd with environmental issues. If the owner and the regulator are the same, then there is a risk that regulations will not be effectively complied to. It can also lead to another extreme where compliance would lead to inefficient transport systems, but which costs are subsidized. Total costs incurred by transportation activities, notably environmental damage, are generally not fully assumed by the users. The lack of consideration of the real costs of transportation could explain several environmental problems. Yet, a complex hierarchy of costs is involved, ranging from internal, compliance, contingent to external. For instance, external costs account on average for more than 30% of the estimated automobile costs. If environmental costs are not included in this appraisal, the usage of the car is consequently subsidized by the society and costs accumulate as environmental pollution. This requires due consideration as the number of vehicles, especially automobiles, is steadily increasing. The relationships between transport and the environment are multidimensional. Some aspects are unknown and some new findings may lead to drastic changes in environmental policies, as it did in regards of acid rain and chlorofluorocarbons in the 1970s and 1980s. The 1990s were characterized by a realization of global environmental issues, epitomized by the growing concerns between anthropogenic effect and climate change. Transportation also became an important dimension of the concept of sustainability, which is expected to become the prime focus of transport activities in the coming decades, ranging from vehicle emissions to green supply chain management practices. These impending developments require a deep understanding of the reciprocal influence between the physical environment and transport infrastructures and yet this understanding is often
lacking. The main factors considered in the physical environment are geographical location, topography, geological structure, climate, hydrology, soil, natural vegetation and animal life. The main environmental dimensions of transportation are related to the causes, the activities, the outputs and the results of transport systems. Establishing environmental policies for transportation thus have to take account of the level of contribution and the geographical scale, otherwise some policies may just move the problems elsewhere and have unintended consequences. A noted example are local, regional policies that have forced the construction of higher chimneys for coal burning facilities and induced the continental diffusion of acid rain. Thus, even if an administrative division have adequate environmental enforcement policies, the geographical scale of pollutants diffusion obviously goes beyond established jurisdictions. In addition to the environmental impacts of the network, traffic and modes, economic, industrial processes sustaining the transport system must be considered. These include the production of fuels, vehicles and construction materials, some of which are very energy intensive and the disposal of vehicles, parts and infrastructure. They all have a life cycle timing their production, utilization and disposal. Thus, the evaluation of the transport-environment link without the consideration of cycles in the environment and in the product life alike is likely to convey a limited overview of the situation and may even lead to incorrect appraisal and policies [3].

THE IMPACT OF TRANSPORTATION ON THE ENVIRONMENT

Transportation activities support increasing mobility demands for passengers and freight, notably in urban areas. But transport activities have resulted in growing levels of motorization and congestion. As a result, the transportation sector is becoming increasingly linked to environmental problems. The most important impacts of transport on the environment relate to climate change, air quality, noise, water quality, soil quality, biodiversity and land take:

Climate change: The activities of the transport industry release several million tons of gases each year into the atmosphere. These include lead (Pb), carbon monoxide (CO), carbon dioxide (CO₂; not a pollutant), methane (CH₄), nitrogen oxides (NOₓ), nitrous oxide (N₂O), chlorofluorocarbons (CFCs), perfluorocarbons (PFCs), silicon tetrafluoride (SF₆), benzene and volatile components (BTX), heavy metals (zinc, chrome, copper and cadmium) and particulate matters (ash, dust). There is an ongoing debate to what extent these emissions are linked to climate change and the role of anthropogenic factors. Some of these gases, particularly nitrous oxide, also participate in depleting the stratospheric ozone (O₃) layer which naturally screens the earth’s surface from ultraviolet radiation.

Air quality: Highway vehicles, marine engines, locomotives, methanogenes, locomotives and aircraft are the sources of pollution in the form of gas and particulate matters emissions that affects air quality causing damage to human health. Toxic air pollutants are associated with cancer, cardiovascular, respiratory and neurological diseases. Carbon monoxide (CO) when inhale affects bloodstream, reduces the availability of oxygen and can be extremely harmful to public health. An emission of nitrogen dioxide (NO₂) from transportation sources reduces lung function, affects the respiratory immune defense system and increases the risk of respiratory problems. The emissions of sulphur dioxide (SO₂) and nitrogen oxides (NOₓ) in the atmosphere form various acidic compounds that when mixed in cloud water creates acid rain. Acid precipitation has detrimental effects on the built environment, reduces agricultural crop yields and causes forest decline. The reduction of natural visibility by smog has a number of adverse impacts on the quality of life and the attractiveness of tourist sites. Particulate emissions in the form of dust emanating from vehicle exhaust as well as from non-exhaust sources such as vehicle and road abrasion have an impact on air quality. The physical and chemical properties of particulates are associated with health risks such as respiratory problems, skin irritations, eyes inflammations, blood clotting and various types of allergies.

Noise: Noise represents the general effect of irregular and chaotic sounds. It is traumatizing for the hearing organ and that may affect the quality of life by its unpleasant and disturbing character. Long term exposure to noise levels above 75dB seriously hampers hearing and affects human physical and psychological wellbeing. Transport noise emanating from the movement of transport vehicles and the operations of ports, airports and railyards affects human health, through an increase in the risk of cardiovascular diseases. Increasing noise levels have a negative impact on the urban environment reflected in falling land values and loss of productive land uses.

Water quality: Transport activities have an impact on hydrological conditions. Fuel, chemical and other hazardous particulates discarded from aircraft, cars, trucks and trains or from port and airport terminal operations, such as de-icing, can contaminate rivers, lakes, wetlands and oceans. Because demand for shipping services is increasing, marine transport emissions represent the most important segment of water quality inventory of the transportation sector. The main effects of marine transport operations on water quality predominantly arise from dredging, waste, ballast waters and oil
spills. Dredging is the process of deepening harbor channels by removing sediments from the bed of a body of water. Dredging is essential to create and maintain sufficient water depth for shipping operations and port accessibility. Dredging activities have a two-fold negative impact on the marine environment. They modify the hydrology by creating turbidity that can affect the marine biological diversity. The contaminated sediments and water raised by dredging require spoil disposal sites and decontamination techniques. Waste generated by the operations of vessels at sea or at ports cause serious environmental problems, since they can contain a very high level of bacteria that can be hazardous for public health as well as marine ecosystems when discharged in waters. Besides, various types of garbage containing metals and plastic are not easily biodegradable. They can persist on the sea surface for long periods of time and can be a serious impediment for maritime navigation in inland waterways and at sea and affecting as well berthing operations. Ballast waters are required to control ship’s stability and draught and to modify their center of gravity in relation to cargo carried and the variance in weight distribution. Ballast waters acquired in a region may contain invasive aquatic species that, when discharged in another region may thrive in a new marine environment and disrupt the natural marine ecosystem. There are about 100 non-indigenous species recorded in the Baltic Sea. Invasive species have resulted in major changes in nearshore ecosystems, especially in coastal lagoons and inlets. Major oil spills from oil cargo vessel accidents are one of the most serious problems of pollution from maritime transport activities.

**Soil quality:** The environmental impact of transportation on soil consists of soil erosion and soil contamination. Coastal transport facilities have significant impacts on soil erosion. Shipping activities are modifying the scale and scope of wave actions leading to serious damage in confined channels such as river banks. The removal of earth’s surface for highway construction or lessening surface grades for port and airport developments have led to important loss of fertile and productive soils. Soil contamination can occur through the use of toxic materials by the transport industry. Fuel and oil spills from motor vehicles are washed on road sides and enter the soil. Chemicals used for the preservation of railroad ties may enter into the soil. Hazardous materials and heavy metals have been found in areas contiguous to railroads, ports and airports.

**Biodiversity:** Transportation also influences natural vegetation. The need for construction materials and the development of land-based transportation has led to deforestation. Many transport routes have required draining land, thus reducing wetland areas and driving-out water plant species. The need to maintain road and rail right-of-way or to stabilize slope along transport facilities has resulted in restricting growth of certain plants or has produced changes in plants with the introduction of new species different from those which originally grew in the areas. Many animal species are becoming extinct as a result of changes in their natural habitats and reduction of ranges.

**Land take:** Transportation facilities have an impact on the urban landscape. The development of port and airport infrastructure is significant features of the urban and peri-urban built environment. Social and economic cohesion can be severed when new transport facilities such as elevated train and highway structures cut across an existing urban community. Arteries or transport terminals can define urban borders and produce segregation. Major transport facilities can affect the quality of urban life by creating physical barriers, increasing noise levels, generating odors, reducing urban aesthetic and affecting the built heritage [3]. Emissions from vehicle travel are responsible for five major categories of costs which may be monetized: human health impacts, materials damage, agriculture damage, visibility degradation and global warming.

**MODEST OF THE TRANSPORT**

**Rail transport:** As one of the most efficient and environmentally friendly ways to move people and goods, railways have a tremendous potential to reduce the environmental impact of transport and improve the quality of life of EU citizens. European policy up to now has failed to properly address the impacts of increasing transport demand, which is a major source of greenhouse gas emissions and a driver of global climate change. There is now an urgent need for action to cut transport-related CO₂ emissions. It is widely accepted that a modal shift towards railways can contribute to meeting EU targets on climate protection and reducing greenhouse gas emissions. A stronger role for rail will help to achieve real progress towards the 2020 target of a 20% cut in the EU’s greenhouse gas emissions. However, concerted action must be taken by governments and policy-makers to help bring this about. The rail sector is doing its part, having already agreed on a voluntary target for 2020, to cut its 1990 levels of specific emissions by 30%. It is also funding research to work towards standardised technologies that will further improve environmental performance. More needs to be done now to get traffic off the roads and on to rail. Real prices have to be charged that reflect the real costs caused by polluters. The wider use of market-based instruments will bring about more cost-oriented pricing and fairer market conditions, which would
lead to modal shift, behavioural changes, and help pay for improvements in rail infrastructure. The greater use of combined transport will allow each mode to use its strengths best – particularly over long distances, where the use of road and rail can complement rather than compete with each other [5].

**Road transport**: Road transport involved about 1/5 of the European Union’s (EU) total emissions of carbon dioxide, the main greenhouse gas. Carbon dioxide emissions from road transport increased by nearly 23% between 1990 and 2010. Without the economic downturn growth could have been even bigger. Transport is the only major sector in the European Union where greenhouse gas emissions are still rising. Road transport is the principal means of transport in the EU for both passengers and goods. The European Union has almost one vehicle for every two residents, and road freight traffic represents more than 2/3 of the total tonnage. EU action focuses essentially on controlling the multiple costs of road transport. Transport development must comply with safety requirements as well as environmental protection. Numbers of aspects of transport are the subject of European regulation, whether this is competition between transport operators, access to the profession, working conditions or the technical standards of vehicles [6].

**Marine transport**: The sea and inland water infrastructure revolves around ports, typically found at the edge of an ocean, sea, river, or lake which receive ships and transport cargo. Most passenger sea travel occurs on ferries and cruise ships, although recreational marine vehicles are also increasing in popularity. Marine vessels emit both nitrogen oxides and particulate matter which contributes to air pollution. Scientists estimate that within 25 years, the marine transport sector could be responsible for doubling the amount of smog-forming pollution. To address the problem, recent regulations have mandated drastic cuts in the sulfur level of marine diesel fuel and in the emissions of nitrogen oxide and fine particulate matter. The majority of waste from marine transport is sludge-like: sewage, graywater, and bilge water, although the sector also produces its share of solid and hazardous waste. Graywater carries with it a variety of chemicals and residues, while bilge water can contain oil, cleaning agents, paint, or metal from routine ship operations. Although many believe that these wastes are greatly diluted when emptied into water, they can still have an effect on mammal and marine life, water quality, and the overall health of the marine ecosystem. Oil spills are rare - spills from marine vessels account for only a small percent of oil in the ocean but they can also have long-lasting effects on marine organisms, introduce toxics into the food chain, and degrade beaches and coastal areas. Finally, the release of ballast water taken in by ships in order to help stabilize the vessels can introduce new and invasive species into areas where they do not naturally occur [7]. Research and development on alternative fuels (biodiesel and hydrogen fuel cells) for watercraft is very important.

![Fig. 1 CO₂ emissions 2005 in EU – 27 by transport mode (million tonnes). Source: European Commission 2007](image)

**AIR POLLUTANTS**

Air pollution is very important source of environmental externalities for transportation. Although the nature of air pollutants is clearly identified, the scale and scope on how they influence the biosphere are subject to much controvers. On the positive side, emissions of the most harmful air pollutants, such as Carbon Monoxide and Volatile Organic Compounds, have declined in spite of a substantial growth in the number of vehicles an indication of growing levels
of environmental compliance of vehicles. Carbon Dioxide emissions have increased proportionally with the growth of transportation usage. One geographical dimension of air pollution is at the local and regional levels where its externalities are immediately felt. The higher the level of concentration of transport activities, the higher their environmental impacts are being felt by the local community. This is particularly the case for large transport terminals, such as ports, rail yards and airports. Many air pollutants have been identified as being closely related to transportation:

**Carbon Monoxide (CO):** Carbon monoxide is a colorless, odorless gas, the result of the incomplete combustion of hydrocarbons. Transportation accounts from 70 to 90% of total carbon monoxide emissions. It is thus the air pollutant the most strongly associated with transportation. Carbon monoxide is often present near major traffic intensive arterials, notably in urban areas. Carbon monoxide is a poisonous gas. When inhaled, it combines with hemoglobin to form carboxyhemoglobin, preventing absorption of oxygen and resulting in asphyxiation. 0.5% of carbon monoxide in air may prove fatal in less than half an hour by transforming over 50% of the hemoglobin in carboxyhemoglobin. Lower concentrations of carbon monoxide may cause poisoning symptoms and affect people with heart, lung and circulatory system weaknesses. It also effects the respiration of plants by inhibiting photosynthesis. Since carbon monoxide is not chemically very stable, direct global effects are strongly limited. Indirectly, carbon monoxide contributes to the formation of greenhouse gasses as a catalyst.

**Nitrogen Oxides (NOx):** Nitrogen oxide (NO or NO₂) is a brown, odorless gas. A by-product of combustion when energy is used to oxide nitrogen instead of an hydrocarbon. Transportation accounts from 45 to 50% of total emissions of nitrogen oxides. Other sources are chemicals (notably nitrates) industrial production and combustion of fossil fuels in thermal power plants. Nitrogen oxides are not very harmful to humans (particularly NO), but when released from an internal combustion engine, high concentrations are often toxic. It irritates and infects the respiratory system and the eyes. Some decreases in the ability to resist bacterial infection were also observed when the subject is exposed to significant concentrations of nitrogen dioxide. Nitrogen oxides are known to prevent the growth of crops and thus reduce agricultural yields. Nitrogen oxides are known to be associated with several global effects and have increased at a rate of 0.2% annually over the last decades. They are a catalyst for ozone, a component of acid rain and a component of smog. Depositions of nitrogen oxides influence the nitrate cycle, particularly in water where it influences algae blooms.

**Hydrocarbons and Volatile Organic Compounds - (HC/VOC):** Hydrocarbons (HC) are a group of chemical compound composed of carbon and hydrogen. When in a gaseous form, HC are called Volatile Organic Compounds (VOC). Several HC and VOC are heavy gazes or volatile compounds with a strong odor. They are mostly the result of the incomplete combustion of gasoline or by-products of the petrochemical industry. They include methane (CH₄), gasoline (C₆H₁₃) and diesel vapors, benzene (C₆H₆), formaldehyde (CH₂O), butadiene (C₄H₆) and acetaldehyde (CH₃CHO). Transportation accounts from 40 to 50% of total emissions of HC/VOC. They can be emitted by incomplete combustion (70%), during refueling (10%) or by evaporation from storage units (20%), particularly gas tanks. For instance, a car parked overnight during summer emits approximately 4 grams of HC/VOC. Other important sources are petrochemical (plastics and solvent) industries. All HC/VOC are carcinogen (cases of leukemia linked with benzene) to some extent, fatal at high concentrations, harmful to crops and accumulates within the food chain (poisoning). However, heavy hydrocarbons (like benzene) are far more carcinogen than light hydrocarbons (like methane). All HC/VOC have several global effects. They are components of smog, catalysts for ozone and components of acid rain.

**Particulates:** Particulates include various solids in suspension in the atmosphere such as smoke, soot, and dust resulting of the incomplete combustion of fossil fuels, notably coal. They may also carry traces of other toxic substances like HC/VOC. Transportation accounts for around 25% of total emissions of particulates. Diesel engines are the main emitters. Other important sources are thermal power plants using coal. Particulates are carcinogen. They are also harmful to lungs tissue and worsen respiratory and cardiovascular problems, notably if their size is smaller than 5 microns. Particulates depositions may alter the aesthetic of structures. The accumulation of particulates in the atmosphere and deposition on leafs may reduce photosynthesis and plant growth.

**Smog:** Mixture of solid and liquid fog and smoke particles formed through the accumulation of carbon monoxide, ozone, HC/VOC, nitrogen oxides, sulfur oxide, water, particulates, and other chemical pollutants. Photochemical smog are those with a higher concentration of ozone and HC/VOC. Smog is strongly linked with transportation and industrial activities, notably in urban areas. Smog is particularly dense during a thermal inversion (static regional air masses that enable the accumulation of pollutants). The effects of smog are the conjunction of those of its major components (see the effects of carbon monoxide, sulfur dioxide, nitrogen oxide,
HC/VOC, particulates and ozone). Based upon historical observations (like London in the 50s), the number of deaths among susceptible persons (respiratory and cardiovascular problems) grows sharply during thermal inversions. Several large cities (like Los Angeles, Tokyo and Mexico) have serious smog problems to the point that emissions reduction policies are established. Smog impairs visibility considerably and causes different annoyances (odors, irritations, etc.). Because of its components, smog is highly associated with acid rains and greenhouse effects.

**Lead (Pb):** Lead is a toxic metal mainly used as an anti-knock agent in gasoline (Lead tetraethyl - Pb(C₂H₅)₄) and in batteries (lead dioxide as an anode and lead as a cathode). Until recently, lead tetraethyl was a main source of atmospheric lead emissions in developing countries. This contribution has dropped in absolute numbers but still accounts for 30 to 40% of total emissions. Batteries are now an important source of lead for transportation, but a very limited amount of this lead is carried through the atmosphere (see water pollution). Extremely poisonous metal. Lead has effects on the metabolism and accumulates in living tissues. May causes anemia, and mental retardation for young children. For instance, an extremely high occurrence of mental retardation in some parts of Mexico city was directly linked with lead poisoning. Small doses may cause behavioral changes. Lead is fixed by plants and animals and re-contaminates the food chain. It has a high potential to accumulate in the environment. Lead can also be transported in the atmosphere over wide distances.

**Odors:** Odors are the subjective perception of the sense of smell. They exists different "shapes" of odors perceived as pleasant, neutral, or unpleasant. A long run exposition to specific odors will attenuate their perception. Diesel and gasoline engines are the major sources of odors accounted by transportation. Odors are particularly prevalent during smog conditions. Odors are at worst an annoyance, but they are linked with the presence of harmful air pollutants like sulfur dioxide, ozone and HC/VOC. People tend to stay or move away from areas having a significant prevalence of odors. Although the pollutants below can have local and regional impacts, their scope is more global.

**Carbon Dioxide CO₂:** Carbon dioxide is a colorless, odorless gas that composes 0.04% of the atmosphere. Whenever there is combustion (oxidation) of fossil fuels, there is an emission of carbon dioxide. Important temperature regulator for the atmosphere, keeping it a +15°C instead of -15°C if carbon dioxide was absent. Transportation accounts for around 30% of total carbon dioxide emissions in developed countries (15% worldwide). About 66% of carbon dioxide emissions from transportation come from the combustion of gasoline, 16% from diesel fuel and 15% from jet fuel. Carbon dioxide emissions by transportation have the following modal breakdown: cars (43%), light trucks (20%), heavy trucks (14%), airplanes (14%), rail and marine (7%) and non-oil based (2%). Other significant natural sources are volcanic eruptions and the metabolic respiration of living organisms (including decomposition). Carbon dioxide is a harmless gas and an essential element of photosynthesis. Although limited concentrations of carbon dioxide have no effects on human beings, high concentrations (5000 ppm) may be harmful by causing breathing disorders. Growing quantities of carbon dioxide in the atmosphere are assumed to be linked with climate change.

**Sulfur Dioxide (SO₂):** Sulfur dioxide is a heavy, colorless gas with a strong odor. It is the result of the combustion of fossil fuels like coal (particularly bituminous coal) and hydrocarbons. Transportation accounts for around 5% of total sulfur dioxide emissions. Although transportation is a minor source of SO₂, related activities like steel and petrochemical industries are important emitters. One of the most important artificial source are thermal power plants using low quality coal. Volcanic eruptions are an important natural source of sulfur dioxide. Sulfur dioxide causes and worsens respiratory and cardiovascular problems. In sufficient concentration, it irritates the eyes and causes discomfort (odor). Sulfur is an essential nutrient for plants but sulfur dioxide is regarded as an inhibitor of physiological activity. Most affected plants are those having a high physiological activity like crops and commercial timber forests. A major component favoring the genesis of acid rain. Sulfur dioxide has a counter effect on greenhouse gases by blocking radiation. This effect is significant enough to be included in climatic models.

**Ozone:** Ozone is a pale blue gas with a strong odor and a powerful oxidant. It is the most common photochemical oxidant. Ozone is created naturally in the high atmosphere when an oxygen molecule is broken apart by ultraviolet radiation and combines with another oxygen molecule. Ozone is also the result of the action of light over a mixture of HC/VOC and nitrogen oxides in the lower atmosphere. It is thus directly linked with transport emissions, notably in urban areas. Ozone is poisonous, hampers breathing and irritates the eyes and the respiratory system at concentrations higher than 0.15 ppm. The normal/natural concentration is around 0.01 ppm at ground levels. It degrades structures (metal and concrete) through oxidation. It damages crops and vegetation and leads to losses of leafs. Depending on the crops and the concentration involved, ozone may reduce yields from 1 to 20%. Ozone impairs visibility. Ozone is essential in the upper atmosphere, as it absorbs light in the ultraviolet band. A drop of 5%
in the concentration of ozone may lead to an increase of 10% of skin cancer and eye cataracts.

**Acid Rain and Acid Depositions (Sulfuric and Nitric Acid (\(H_2SO_4\), \(HNO_3\)):** Sulfuric acid is a corrosive, oily colorless liquid, which forms when sulfur oxides and water vapors are mixed. Nitric acid is a corrosive and colorless liquid and forms when nitrogen oxides and water vapor are mixed. The level of formation of acid (sulfuric and nitric) is influenced by the level of exposition to sun light. It may also exists in dry form, which is called acid deposition. When dissolved in water, sulfuric and nitric acids lower the pH (higher concentrations of hydrogen ions). The standard pH of fresh water ranges between 6.5 and 7.5. Since transportation accounts for 5% of sulfur dioxide emissions, 45% of nitrogen oxides emissions and for 40% of HC/NO\(_x\) emissions, sources may range from 10 to 30% of acid rains, depending on regions. This figure is of 25% in Western Europe. Sufficient concentrations of sulfuric of nitric acids are known to damage artificial structures, thus historical monuments are particularly vulnerable. When inhaled as a mist, may cause respiratory organs irritation. Change the chemical composition of soils by breaking down complex organic matter in simpler elements. At a small scale, this is beneficial, but at a large scale, it reduces the available biomass. By altering the pH of fresh water, acid rains gradually destroy life in lake and rivers. Sulfuric and nitric acids are carried over large distances through weather systems. It later falls down either as rain or fog. Acid rain and acid depositions are known to alter the ecological balance of continental ecosystems, notably in industrialized areas.

**Chlorofluorocarbons (CFCs):** CFCs are colorless and poisonless gases (or liquids). They are very stable, non-flammable and non-toxic components and they have been widely used as dispersing agents (aerosols) or as refrigerants (notably Freon, R-12). For transportation, motor vehicle air-conditioning systems are the main source and account for about 20% of all CFCs emissions. In fact, during its life cycle, an air-conditioning system will release 100% of its CFCs in the atmosphere. With recent legislations, CFCs emissions have considerably subsided in developed countries but not in developing countries. Because of its chemical properties (stable and non-toxic), CFCs have no noticed effects on living organisms. Current concentrations of CFCs in the atmosphere reach about 0.35 ppm (all types of CFCs) but the most widely used type, R12, has 20,000 times more infrared absorbency than carbon dioxide. Thus one ton of Freon will have the same greenhouse effect than 2,000 tons of carbon dioxide. CFCs reduce the concentration of stratospheric ozone, which absorbs harmful ultraviolet rays. CFCs may stay in the atmosphere from 70 to 200 years, due to their extremely stable properties. They are a long term component of the atmosphere. CFCs emitted during the 1990s are likely to damage the ozone layer for 200 years. Indirect effects of CFCs (increase in ultraviolet rays exposition) include growths in the incidence of skin cancer, eye cataracts, damage to crops and plants, deficiencies of the immune system and increase of ozone at ground levels (through photochemical smog). Even though transportation contributes significantly to the emission of air pollutants new technologies (catalytic converters) and policies have reduced emissions significantly [8].

**CONCLUSION**

The growth in vehicle numbers and use is a threat to the environment and the health of European citizens. The thematic strategy on atmospheric pollution fixes targets for the reduction of certain pollutants and reinforces the legislative framework to combat atmospheric pollution using a two-pronged approach: improving Community environmental legislation and including air quality considerations in related policies. As provided for in the strategy, the Commission has proposed a new "EURO V" standard to reduce polluting emissions from light motor vehicles and in particular reduce emissions from vehicles with diesel engines by 80%. The strategy also envisages a number of measures to reduce emissions of SO\(_2\) and NO\(_x\) from ships [9]. The Clean Air Act encourages development and sale of alternative fuels. Alternative fuels are transportation fuels other than gasoline and diesel, including natural gas, propane, methanol, ethanol, electricity, and biodiesel. These fuels can be cleaner than gasoline or diesel and can reduce emissions of harmful pollutants. Renewable alternative fuels are made from biomass materials like wood, waste paper, grasses, vegetable oils, and corn. They are biodegradable and reduce carbon dioxide emissions. In addition, most alternative fuels are produced domestically, which is better for our economy, energy security and helps offset the cost of imported oil [4]. Vehicle noise emission limits have not been technology-forcing since their introduction and were last tightened in 1995. This means these limits have not been updated for twelve years, in stark contrast to vehicle air pollution emission standards, which have been tightened three times over the same period. In the case of both road and rail traffic, there are already vehicles/rolling stock available that are well within current noise standards. Besides the vehicles themselves, examples of silent tyres/wheels and road pavements/tracks show also room for noise reduction. At noise ‘hotspots’ additional, local measures can be implemented. Low-noise road surfaces, such as thin-layer, double-layer, porous and poroelastic pavements, offer considerable potential to cut road noise dramatically, and are
very complementary to technical measures to reduce engine, exhaust and tyre noise from cars and trucks. Such surface measures have the advantage of bringing immediate benefits, particularly for use in noise hotspots. The noise of a road can also be reduced by influencing the speed or flow of the traffic it carries. Limiting traffic speed reduces its noise, especially between 50 and 80km/h. As an initial step to reduce the noise emissions of rail transport, the use of composite brakes on freight wagons should be promoted [10]. Reducing transportation’s greenhouse gas emissions will be difficult because demand for mobility of both people and goods will certainly continue to grow. Increasing transportation activity will result in growing energy use and greenhouse gas emissions, unless the energy efficiency of vehicles can be increased, alternative energy sources developed, and ways found to improve the ability of land use and transportation systems to provide accessibility with less motor vehicle travel.

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