The impact of road transport on the environment*

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Abstract. *Transports play an essential function for the socio-economic development of a region or country. The transport not only provides access to jobs or leisure, housing, goods and services to residents, but it also facilitates relations between countries. The impact of the road transport on the environment is highlighted on the level of all environmental factors through: traffic congestion and accidents; air pollution; noise and vibrations – at the major intersections along roads, near transport nodes; soil and water pollution; occupation of land in urban areas for parking areas; changing eco-urban landscape; production of solid waste (tires, accumulators etc.).*

Key words: air quality, environment, road transportation

1. Introduction

This paper describes few steps in achieving an urban and regional development strategy, starting from the analysis of existing infrastructure. It will monitor the traffic that connects arteries, such as road intersections or major street network. It will analyze how traffic connections are made, given by the need of regional integration and taking into account European standards.

Pantelimon town has been formed in an area without a functional infrastructure to support it town life. As long as the population of an urbanized area grows, the city's infrastructure must grow with it, or else shortages will develop, typically in housing, education, transportation, clean water and waste removal services, or other services such as law enforcement. The urban and traffic interventions have the ultimate goal for continuing decreasing air pollution in a small town like Pantelimon town.

Pantelimon town is located east from Bucharest, at short distance. Pantelimon town covers an area of nearly 135 square kilometers and has a stable population of 18.898 inhabitants, of which 9253 are men and 9645 are women. The town is crossed by two county roads (DJ 100 A, DJ 301) and a national road (DN 3), road leading to Black Sea.

Location of Pantelimon town can be considered a metropolitan area of Bucharest because it includes not only the urban area, but also satellite cities plus intervening rural land that is socio-economically connected to the city.

Figure 1: The map of the Pantelimon town in relation to the city of Bucharest

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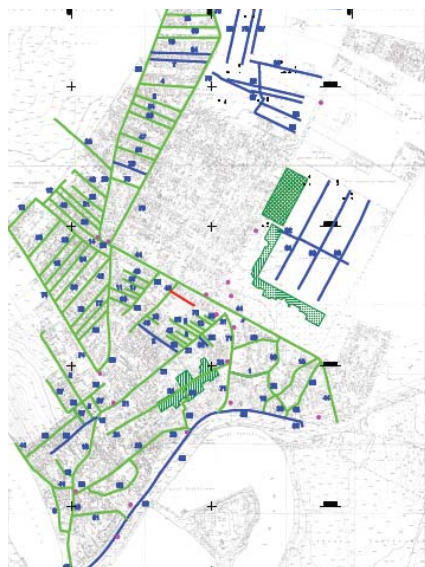

Figure 2: Road network and the location of individual components of the Integrated Project for Pantelimon town

2. The impact of road transport on the environment

The law 104/2011 concerning ambient air quality, which implements the regulation 2008/50/EC of the European Parliament and of the European Council on ambient air quality and cleaner air for Europe, is the governing law when conducting ambient air quality evaluations.

The considered air pollutants in evaluating ambient air quality are:

- sulphur dioxide (SO_2)
- nitrogen dioxide (NO_2)
- nitrogen oxides (NO_x)
- suspended particulate matter (PM10 and PM2, 5)
- lead (P_b)
- benzene (C_6H_6)
- carbon monoxide (CO)
- ozone (O_3)
- arsenic (As)
- cadmium (Cd)
- nickel (Ni)
- polycyclic aromatic hydrocarbons / Benzo (a) pyrene (BaP)
- mercury (Hg)

Transports play an essential function for the socio-economic development of a region or country. The transport not only provides access to jobs or leisure, housing, goods and services to residents, but it also facilitates relations between countries.

Among all transport types in Romania I will refer to the road transport only, since it has the greatest impact on the environment.

The impact of this type of transport on the environment is highlighted on the level of all environmental factors through:

- traffic congestion and accidents;
- air pollution, as a result of emissions;
- noise and vibrations – at the major intersections along roads, near transport nodes
- soil and water pollution;
- occupation of land in urban areas for parking areas;
- changing eco-urban landscape;
- production of solid waste (tires, accumulators etc.).

One of the most significant consequences that transportation has on human health, is connected to harmful exhaust gases containing NO_x, CO, SO_2, CO_2, volatile organic compounds, heavy metal particles (lead, cadmium, copper, chromium, nickel, selenium, zinc), pollutants combined with particles generated from the road. All these can cause acute and chronic respiratory problems or might even worsen other diseases. Heavy traffic generates high levels of noise and vibrations, which causes stress conditions, sometimes with major implications on health.

In terms of environmental impact, there is a wide range of factors that influence the increase of CO_2 emissions resulted from road transport, such as supply and demand for cars, individual mobility needs, availability / non-availability of alternative public transport services and associated costs of a personal car.
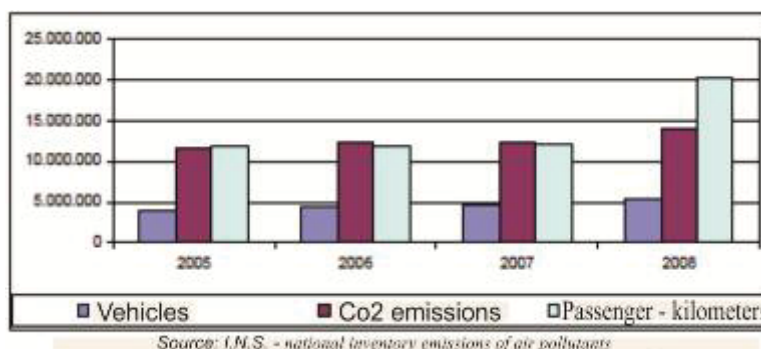

Figure 3: CO_2 emission trends depending on the vehicles fleet and the number of passengers – kilometric

In this context I should mentioned some of the priorities set and other public policy documents and institutional commitments (sectorial strategies, national development plans as well as other development programs):

- modernization and development of transport infrastructure in order to improve service and environmental quality, traffic safety and security as well as to ensure interoperability of the transport system
- strengthening of social and territorial cohesion at national and regional level by providing connections between cities and increasing population´s accessibility to the public transportation, including areas with low population density and / or dispersed centers
- increasing competitiveness in the transportation sector and the liberalization of the domestic transportation market
- improving transport behaviour in relation to the environment, reducing the global impacts of the transport (climate change) and reduce degradation of environmental quality in natural and urban environment.

Considering the regional development, Region 1 North - East has the highest length of public roads whereas the Region 8 Bucharest - Ilfov, has the lowest value of the length of public roads, a situation highlighted in Figure 4.
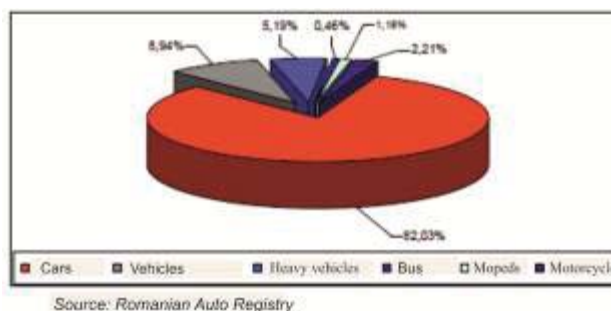

Figure 4: Vehicles fleet structure in 2009

The connection intercity - city transportation is essential for achieving sustainable transport. A great part of the demand but also of the negative effects of transportation is concentrated in the cities. Goals such as improving efficiency and quality of transport services, strengthening social and territorial cohesion, reducing greenhouse gas emissions can be achieved only if a proactive strategy in the urban areas it´s adopted.
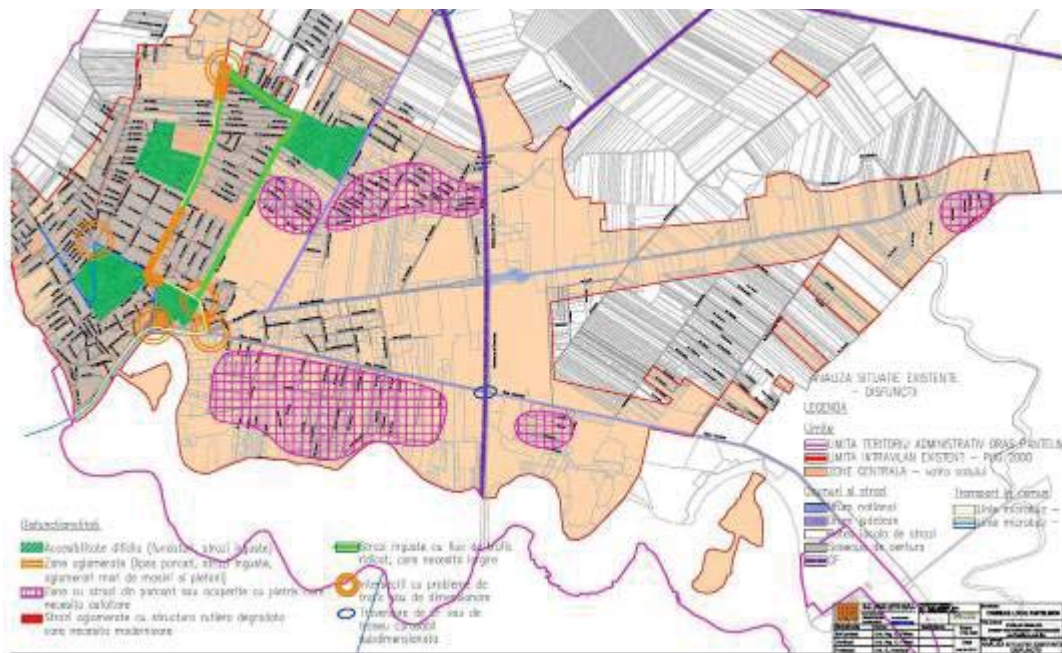

Figure 5: Part of the draft traffic strategy for the Pantelimon town, analyzing the existing situation

3. Considerations regarding the current situation on the transport-environmental factors relation

Air

The road transport impact on the air quality has increased because of the growing number of private owned and new public vehicles and also due to the increased mobility of passengers and goods, both in the national and international transport area. The most significant emissions produced by the transport sector are: nitrogen oxides, sulphur oxides, suspended particulate matter (PM), VOCs and heavy metals (eg lead). The air pollution in Romania´s cities is largely due to transport, but there is no data to make a comparison between pollution caused by private transport and public transport or other means of transportation could causing pollution.

Water

Transportation is not the main factor contributing to the water pollution, though it affects surface water quality and indirectly groundwater due to soil pollution.

Soil

Soil pollution generated in the transport sector is largely caused by air emissions through direct discharges (oil, fuel and chemicals) and leakage on road surfaces that are then washed by rain. Soil pollution in Romania that it is caused by traffic occurs generally only locally, and it appears through the indirect effect on the quality of surface water and groundwater. Anti-freeze substances used in winter roadway surfaces are also a potential source of pollution.

Climate changes

According of the 3rd National Communication concerning the candidate country, in 2001, 11% of greenhouse gases emissions in Romania were due to the transport sector. The total net emissions of greenhouse gases fell by about 50% in 2002 compared to the reference year 1989. This decrease was mainly due to significant decrease of industrial production (by lowering energy consumption and closing some old industry branches) and economic restructuring in transition to the free market economy, but not due to specific measures and policies to reduce emissions. Contrary to the achieved reduction of greenhouse gases emissions generated by the industry, stands the increasing share of greenhouse gas emissions produced by the transport sector, a tendency noted also in the EEA TERM report 2005 Report (No.3/2006).

«Natura» Ecological Network 2000

In Romania has 5 of the 11 European bio-geographical regions, which is the largest number of biogeographical regions owned by a single EU country. «Natura 2000» is still in the process of development and should be completed by the end of this year. 190 SPA (Special Protection Avifaunistical areas) has been identified, representing approximately 27% of Romania's territory, and also other 370 SCI (Sites of Communitary Importance), representing approximately 14% of the Romanian territory. There are areas where anthropogenic activities have had negative effects on wildlife conservation. Constructions of roads and transport corridors have a direct and usually irreversible impact on ecosystems and biodiversity. At this time, Romania has one of the lowest levels of fragmentation of habitats, which represents a great when it comes to nature conservation.

Nature and cultural heritage

Transportation and transport infrastructure have a direct impact on the natural landscape of the country. The construction of highways is a desiderable goal for Romania, and this changes the natural landscape rapidly. Land is under continuous pressure resulted from the new transport infrastructure. Roads are the largest consumer of land, followed by railways.

Transport and environment users

Responsible behavior towards the environment experienced by transport users suffered heavily due to lack of investment in public transport system and due to its development´s neglection in Romania of the last decade. Transport users turned to

purchase/ use personal cars, so they increased investments in this area. This practice has increased with the recent evolution of economic development. Alternative means of transport such as cycling and walking, were not promoted in Romania, thus damaging environmental factors (especially increasing air pollution in urban areas) disadvantaged a sustained support in promoting such measures.

In addition, there is no easy access for the elderly or disabled to public transport because the appropriate infrastructure is generally missing. So far, few measures have been taken to promote and raise awareness regarding environmental responsibility in connection with transportation.

5. Conclusion

The urban and traffic interventions have the ultimate goal for continuing decreasing air pollution in a small town like Pantelimon town.

Main proposals and the role traffic regulations to reduce air pollution consist:

- Build a road of Bucharest on the territory of the town Panteleimon for transit traffic with the roadway 15.00 m (2-lane), assimilated to the category "highway" (design speed 100 km / h).
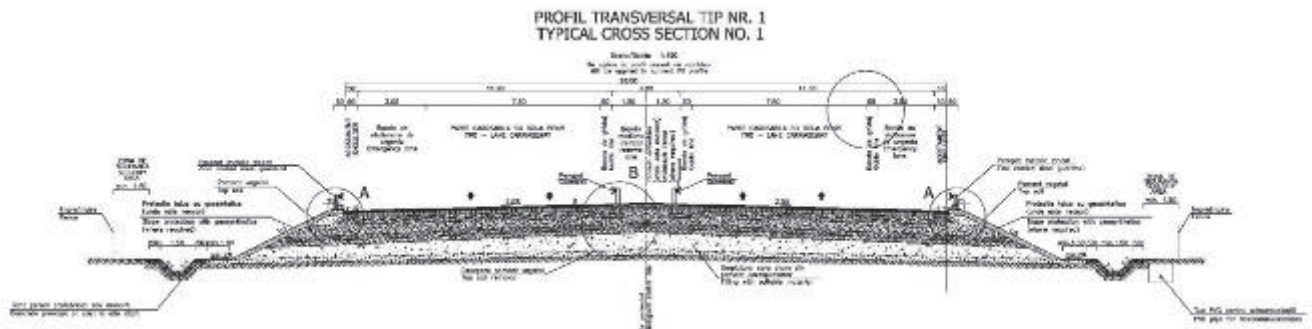
- The ring road is proposed to two lanes.
- General improvement of the state of pavements by applying viability of clothing, mainly of paving, where the support is from the earth.
- Development of road infrastructure in older areas of housing, to balance the functional areas of the city and increase comfort.
- New routes that include a pedestrian bicycle lanes.
- Construction of a road bridge over the belt.
- Establishment of pedestrian crossings.
- Green corridors for road infrastructure safety
- Many green areas in the city and suburbs

The ring road upgrading has an essential contribution not only to the traffic safety, by decreasing traffic disruptions within cities, but they also have an important impact on the environment by reducing pollution inside the cities.

All these proposals will bring further advantages such as diminishing the negative environmental impact through drastically reduction of pollutant emissions in accordance with the transport policies applied by the European Union.
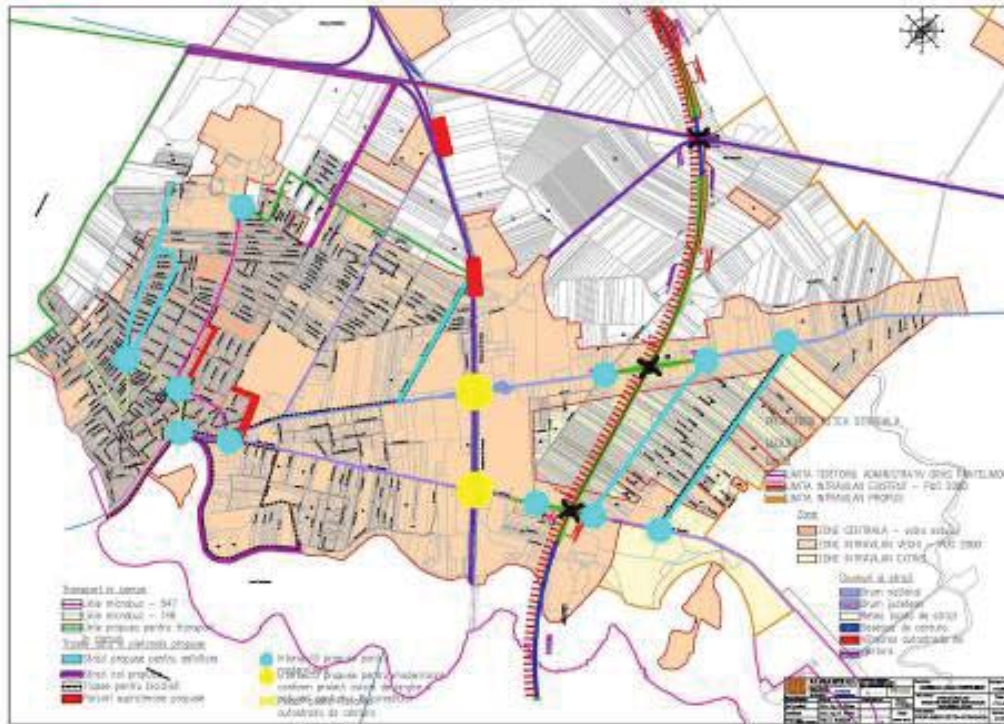

Figure 6: Part of the draft traffic strategy for the Pantelimon town, proposal

References

[1] ANPM, Environmental Protection Agency Bucuresti (2011), Annual Report- Air Quality in Romania 2011

[2] ADR Bucureşti-Ilfov, Regional Development Agency Bucharest-Ilfov (2004), Regional Development Plan 2007-2013 Bucharest-Ilfov prepared in accordance with Law 315/2004 and Government Decision 1115/2004, page 49

[3] Citty Hall Pantelimon (2007) Integrated urban development plan 200-2013

[4] Dufek, J., Kotek, Z., (2000) Traffic simulations, Transport Research Centre, Czech Republic

[5] Primacons Group, Search Corporation (2010), Traffic study, traffic analysis and forecast, Citty Hall Bucharest, Romania.