Background paper

Challenges and possible solutions for sustainable urban transport in Tbilisi

Workshop on Sustainable Urban Transport and Land Use Planning
18-20 October 2006, Tbilisi, Georgia

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Foreword

The Georgian Ministry of Environmental Protection and Natural Resources has prepared the present document, in consultation with representatives from health, transport and land-use planning sectors, as one of the background documents for the Workshop on Sustainable Urban Transport and Land-use Planning (Tbilisi, 18 - 20 October 2006). The Ministry organized the workshop in collaboration with national partners as well as the secretariats of the United Nations Economic Commission of Europe (UNECE) and the WHO Regional Office for Europe, within the framework of the Transport, Environment and Health Pan-European Programme (THE PEP). The Netherlands and Switzerland have provided the funds for its organization.

The workshop focuses on urban transport in Tbilisi as well as in the other principal towns in Georgia and the other South-Caucasian countries, Armenia and Azerbaijan. It brings together the stakeholders from local and national levels that influence urban transport policies and -practice in South-Caucasus as well as across the UNECE and WHO/Europe region. Its main objectives are to:

1. Increase awareness of the health and environment hazards of the current urban travel patterns;
2. Exchange experiences and strengthen capacity of the national and local administrations in promoting healthier and more environmentally friendly urban transport, with a focus on:
    - improving collaboration between relevant sectors and tiers of government as well as the private operators;
    - promoting more sustainable modes of urban transport, notably public transport;
    - assessing environment and health impacts of urban transport.
3. Issue recommendations for consideration by the national and local governments in Georgia South-Caucasus.

Executive Summary

This background document provides a brief overview of the transport-development in Tbilisi, the capital of Georgia, and its impact on the health and environment of its population. It aims to describe the key barriers to the development of sustainable and safe urban transport and identify possible ways of mitigating negative external effects of road traffic.

The urban population in Georgia continues to expand. In parallel, Georgian cities show signs of growing transport related environmental stress, such as poor air quality, excessive noise, traffic congestion, loss of green areas and degradation of historical buildings and monuments. Transport is also contributing to an increasing share of CO2 emissions.

The exposure of the urban population to excessive concentrations of air pollutants is reflected in increasing incidences of respiratory system diseases. Furthermore, and in spite of the reinforcement of the traffic safety legislation, the number of people killed and injured in road accidents continues to grow.

Tbilisi, with its one and a half million inhabitants, is home to more than 30 per cent of the population of Georgia. The city, especially the city centre, was not designed to accommodate the current number of motor vehicles (in 2004: 128 988 registered units of vehicles). The river valley, which determines the city's elongated shape, prevents a smooth operation of a large number of vehicles as well as a dispersion of air pollutants. Four-fifths of the Tbilisi air pollution result from road transport. Despite the recently improved road conditions, renovated traffic-light system and some restrictions on vehicle movements in the city centre, traffic jams occur frequently on Tbilisi's streets and avenues.

Aside from the growth of freight and passenger transport, the inefficient traffic management and bad driving habits, the high age and the poor technical condition of most vehicles contribute to the problem. Today the vehicle fleet consists mainly of imported European second-hand cars, from which the catalytic converters are often destroyed or removed, as well as of Soviet-made vehicles. The annual inspection of emissions and technical conditions of the vehicles is currently not compulsory. Consequently, according to the Traffic Police, in 2004 only 3% of the vehicles operating in Tbilisi were subjected to technical inspection.

The existing standards set the maximum level of lead in petrol at 0.013 grams per liter. In practice, lead concentrations average substantially higher values. Few of the fuel-testing laboratories are functioning, the lab equipment is insufficient and the testing protocols are not being enforced. Gas stations do not properly identify fuel quality. Hence, it is difficult to obtain accurate information on fuel quality.

The Tbilisi municipality has improved the public transport system (mainly the bus sector) during the last 2 years. "New yellow" buses were imported from the Netherlands and Ukraine with the intention to replace privately owned minibuses. Nevertheless, the minibus sector remains strong (and highly uncontrollable). Tram services still suffer from the lack of finances, resulting in the poor state of the vehicles and infrastructure. The opposite situation prevails in the subway system: a number of underground stations are being renovated and the existing fleet is scheduled to be renewed in order to become more comfortable and attractive for passengers.

Law-enforcement activities are weak, mainly due to lack of coordination among the relevant authorities and inconsistencies in the legislation.

Key barriers to the development of sustainable urban transport in Georgia can be summarised as follows:

- Lack of instruments (legal, administrative, economic) to ensure the sustainability of the system;
- Insufficient co-ordination among diverse levels of the government and at the local authority level; lack of co-ordination of goals and tasks to improve sustainability of urban transport; lack of integration among three sectors – transport, environment and health;
- Lack of co-ordination of policies, goals and objectives for transport, city planning, environment and health protection at the local level;
- Weak legislation and lack of enforcement tools;
- Insufficient priority given by the authorities to reducing the negative environmental and health effects of the private car use;
- Inefficient traffic management and the still weak public-transport sector;
- Inefficient monitoring of emissions; lack of reliable data on transport-related air pollution, lack of information on health of the exposed population;
- No vehicle emission control system;
- Low public awareness of the problems mentioned above;
- Weak consultation and participation of the public and other stakeholders in the decision-making process.
- Lack of a comprehensive and forward-looking transport-demand management plan.

Recommendations for actions to tackle these problems are presented on pages 18-21. The recommended actions aim at:

I. Improving transport, environment and health policy integration and institutional cooperation, through:

1. Agreements and Memoranda on inter-sectoral cooperation
2. Creation of a permanent inter-agency coordination body
3. Joint monitoring and inspection.
4. Institutional strengthening

II. Shifting the demand for urban transport towards more sustainable modes, through:

1. Improvements to the transport options
2. Market and pricing reforms
3. Parking and land-use management

1. Introduction

Low quality of air in urban areas is one of the main concerns of environmentalists throughout the world. Georgia is not an exception. In the 1980s Georgian cities: Tbilisi, Rustavi, Kutaisi, Batumi and Zestafoni, were among the most polluted cities of the Soviet Union, due to emissions of air pollutants from transport and large industrial enterprises. Over the 1990-1992 period, due to the industrial breakdown and the sharp decline in transport activity, the quality of air temporarily improved. Starting from1993, however, the recovery of the transport sector meant that the quality of air in big cities started to deteriorate again. Since 1996 the Georgian industry started to steadily grow as well, although it is unlikely to reach the production levels of the former Soviet industrial "giants".

Today, transport and industry are again the main economic activities that damage Georgia's environment. Transport sector being accountable for most of the urban air pollution. The gradual development of environmental policies and legislation and their implementation within these sectors during the past decade, has not been able to reverse that fact.

The urban population in Georgia continues to increase and Georgian cities continue to show signs of growing environmental stress - poor air quality, excessive noise, traffic congestion, loss of green areas and degradation of historical buildings and monuments. Externalities, especially from transport activity, are increasingly responsible for deterioration in the quality of life and human health.

Tbilisi, with its one and a half million inhabitants, is home to more than 30 per cent of the population of Georgia.

Four-fifths of the Tbilisi air pollution result from road transport. Aside from the growth of freight and passenger transport, the inefficient traffic management, bad driving habits and the poor technical condition of most vehicles contribute to the problem. The capital has become saturated by road transport. Most of the vehicles are 10-15 years old. The number of Soviet-made models has decreased, being mainly replaced by second-hand European cars. There are no restrictions on the age of vehicles on the road, even in the case of public transport.

Available data indicate that mobile sources are responsible for an increasing share of total air emissions, their contribution rising from some 70% in 1991 to about 91% in 2005. Mobile sources contributed 38% of dust, 82% of SO_2, 89% of NOx, 90% of the volatile organic compounds (VOC), and 95% of CO emissions in 2005 (see table 1). Transport is also contributing an increasing share of CO_2 emissions.

There are no regularly available data on other important transport sector emissions, such as ozone (O_3), noise or persistent organic compounds and heavy metals, such as lead (Pb) and polycyclic aromatic hydrocarbons (PAHs). For a number of reasons (e.g. the age and origin of vehicles, deficient fuel-control and vehicle - control systems, inefficient management of road traffic and public transport), the motor vehicles operating in Georgia generate very dirty emissions.

Table 1. Emission of air pollutants from mobile sources

YEARS	THOUSAND TONNES						
	TOTAL	NO_X	VOC's	CO	SO_2	SOOT	CO_2
2005	246.035	17.179	40.602	178.561	5.710	3.983	-
2004	199.058	12.849	32.028	147.842	3.771	2.568	1444.2
2003	170.096	10.226	26.777	128.758	2.612	1.723	1178.3

Source : Division of Air Protection, Ministry of Environment Protection and Natural Resources of Georgia, Tbilisi, 2006

2. Key barriers to the development of sustainable urban transport in Georgia

2.1 The roadworthiness of vehicles. The age of most of the 342 000 road vehicles operating in Georgia, in both public and private sectors, ranges from 10 to 15 years. This is only one reason for the typically poor condition of these vehicles. The number of second-hand European cars has increased significantly. However, catalytic converters are often destroyed or removed from imported cars to allow the use of leaded petrol, which is more widely available than unleaded petrol. The current vehicle fleet mainly consists of imported second-hand European cars (about 10-12 years old), although the share of Soviet-made cars is still high. Russian models generally consume more fuel and produce more emissions. Owners of old cars have hardly any incentives to maintain them properly.

It should be noted that according to the 2004 amendment to "The Georgian Law on Traffic Safety", the annual technical inspection of vehicles has become voluntary rather than mandatory until January 2007. This measure was intended to reduce corrupt inspections. Not surprisingly, only a small minority of motorists would like to have their vehicles inspected and pay for this service on a voluntary basis. According to the Traffic Police in Tbilisi, in 2004 only 3% (3 939 of the 128 988 registered units) of vehicles underwent a technical inspection.

Another reason for the poor technical condition of many vehicles is the inefficient car service system. The servicing is often performed by car mechanics without any special qualification or by garages without any certificate. The mechanics lack knowledge of modern automobile systems, and an understanding of modern emission control systems.
Furthermore, there are no restrictions on the age of vehicles on the road, not even in the public transport sector.

It is obviously necessary to upgrade the vehicle control system while allowing for specific inspection procedures for the Soviet-made and European models as well as the old and new cars.

2.2 Traffic management. Although more than half of the Georgian population lives in cities, urban areas are not well planned to separate their inhabitants from poorly controlled sources of pollution. As a result, residents are exposed to extreme air pollution, hazardous materials and other wastes, and noise from traffic. Road and parking lot designs promote traffic congestion, and result in increased emissions from vehicles. Parks and recreational green areas are very limited in cities. Over the previous decade that saw the development of a market economy, new commercial ventures, marketplaces and service facilities have been built without due regard for the environment.

In 2000, there were about 70 vehicles per 1 000 inhabitants. In July 2005 according to the information received from the Department of Patrol Police there were about 79 vehicles per 1 000 inhabitants in Georgia and about 100 vehicles per 1 000 inhabitants in Tbilisi (see table 2).

Table 2. Registered motor vehicles in Georgia

YEAR	MOTOR VEHICLES TOTAL (THOUSAND)	OF WHICH:			
		LORRIES AND TRUCKS (INCLUDING PICK-UPS AND VANS)	BUSES AND MINIBUSES	SPECIAL	PASSENGER CARS
2000	313.7	47.0	19.8	2.1	244.8
2001	319.6	47.0	22.7	2.1	247.8
2002	323.6	45.5	24.1	2.0	252.0
2003	325.0	42.9	25.7	1.2	255.2
2004	-	-	-	-	-
2005	341.523	-	-	-	-

Source: *Department of Patrol Police, Ministry of Internal Affairs of Georgia.*

Tbilisi, especially the city centre, was not designed to accommodate the current number of automobiles. The river valley, which gives the city an elongated shape, prevents an efficient operation of a large number of vehicles, as well as a dispersion of air pollutants. The poor organization of traffic and parking increases congestion.

The city's network of avenues and major streets is not suitable for heavy road traffic.
An additional burden to the municipality is posed by transit traffic. Transiting cars pass through main avenues and streets of the town. Only the two main roads linking Tbilisi with the west are adapted to reasonably heavy traffic and even they could not carry the load suitable for a major transit artery.

The inappropriate organization of traffic results in jams and poor air quality. Main streets (Rustaveli av., Tsereteli av., Kostava St.) in Tbilisi are overloaded (4 200-4 500 vehicles per hour in both directions). Some measures to unburden streets have been initiated. Local authorities have decided to ban minibuses from the main central streets where they should be replaced by large buses. This seemed to be a very important measure for reducing air pollution from transport emissions in the city centre, but a number of minibuses move now through the parallel streets and avenues. On the whole, the environmental problems of the city have not changed. It should be mentioned that the environmental and health authorities as well as the general public were not involved in the decision - making process.

Also in order to optimize traffic flows in the city center, the municipal government decided to set up the so-called "Triangle" route, permitting traffic in one direction only in the most frequented area. Once again, the environmental and health authorities did not participate in the decision - making process. Afterwards, concentrations of four air pollutants were measured on three sites within the "Triangle". The results indicated that the permissible values of concentration were exceeded on all three sites. Because no comparable data were collected before the new arrangement, it has not been possible to assess the efficiency of the project at hand.

It should be stressed, nevertheless, that the Tbilisi municipality has made a great effort to improve the road conditions in the city. An extensive rehabilitation of Tbilisi roads has being carried out during the last two years. The municipal budget expenditure pertaining to this activity reached GEL 82.3 million in 2005 (18.9% of budgeted outlays), which was 61.4 million more than in 2004.

***2.3 Fuel quality*.** The composition of fuel affects vehicle emissions. For instance, high lead or benzene levels in petrol cause high lead and benzene concentrations in exhaust emissions.

Gasoline and diesel are imported products that have to be certified. The Georgian certificate for the fuel imported from NIS countries (usually diesel) is based on the corresponding NIS certificate. As a result, very little diesel fuel is tested. For the fuel originating elsewhere, the importer must submit a sample to an accredited laboratory. However, the laboratory analysis is carried out according to outdated Soviet norms from the 1970s. Only the RON and lead content are measured. Few of the fuel-testing laboratories are functioning properly, their equipment is inadequate and/or the testing protocols are not strictly enforced. Gas stations do not properly identify fuel quality. On the whole, it is difficult to obtain any accurate information on fuel quality.

Leaded petrol is still a serious problem in Georgia. According to the existing standards maximum level of lead in petrol is 0.013 grams per liter. The law also stipulates that fuel quality ought to improve gradually from 2005 onward (with the maximum level of lead in petrol approaching 0.005 grams per liter), but the implementation has been delayed until 2007 due to the possibility of negative social consequences (e.g. increased prices on products and services) and difficulties with enforcement. In practice, lead concentrations are on average substantially higher than statutory limits. A major problem is posed by the illegal import of low-octane petrol, which is then upgraded with lead additives to increase the octane level.

Various automobile technologies have different fuel-quality requirements. Soviet models can run on low-octane gasoline; European models run better on higher-octane gas. One way to increase the fuel's octane level is to add lead to it. Also, many older cars require leaded petrol because the lead lubricates and protects their soft valves. The EU standards require catalytic converters on petrol-powered cars, assuming that engines are designed for high octane/unleaded petrol (lead destroys catalytic converters).

Improving fuel quality and the use of good quality gasoline will require a number of interrelated policy interventions, such as:

- changes to the criminal code and the administrative code (with strict criminal and administrative sanctions for non-compliance);
- implementing improved fuel standards;
- developing modern refining capacities (to produce lead-free high octane gas);
- implementing better controls of imported fuel at the border;
- improving fuel-testing procedures and equipment;
- implementing strict inspection of the wholesale and retail distribution network;
- requiring exact labeling of fuel at gas stations;
- increasing public awareness of fuel-quality issues and specific vehicle fuel requirements;
- gradually replacing the old car fleet;
- creating a regulatory environment conducive to the improvement of garage services and repairs;
- improving vehicle testing;
- banning the import of lead, except for small quantities for scientific research;

- and developing an appropriate monitoring and control system.

An elementary but important point should not be forgotten: people respond to incentives. The owner of an old car is not motivated to maintain it well. Similarly, given the existing differences in petrol prices, consumers often prefer the cheapest (and most polluting) brand even if other choices are financially affordable. Unless the market prices reflect full (i.e. both internal and external) costs, neither consumers nor producers can be expected to make environmentally wise choices. Setting the prices right is an important challenge to policymakers, and not only in Georgia.

2.4 Legislation and law-enforcement problems. The Georgian legislation on transport and environment consists of different laws, presidential decrees, orders, rules and regulations: Law on "Road transport" (1995); Law on "Ambient air protection" (1999); Law on "Traffic Safety" (1999); Law on "State Management and Regulation of Transport and Communications" (2001); Tax Code of Georgia (2005); Presidential decree #528 on "The Concept of Transport Policy of Georgia" (1997); Presidential decree #302 on "Improvement of Environmental Safety of Road Transport" (2001); Government decision on "Fuel Quality standards"; Presidential decree # 258 entitled "About the approval of the State program on Traffic Safety in Georgia". In addition to this, some amended Soviet norms pertaining to the environment and transport are still legally binding in Georgia.

Law-enforcement problems are mainly due to inconsistencies in the legislation. A solution to this problem calls for resolute measures, based on a more coherent legislation that would decrease air pollution with the aid of various administrative and economic instruments.

Level of Excise duty on fuel changed as new Tax Code of Georgia has entered in effect since January 2005. According to the new code, the excise duty per ton of motor fuel ranges from GEL 250 for light fuel(petrol) to GEL 220 for the medium blend fuel and GEL 150 for heavy fuel (diesel) ($100=GEL 180). The previous tax code set the excise duty for motor fuels at the uniform 60% of the customs value.

It should also be stressed that the Tax Code defines the excise duty for imported vehicles as follows:
LDVs (light duty vehicles) less than one year old – GEL 1.5 per cm^3 of engine capacity;
LDVs from 1 to 2 years – GEL 1.4 per cm^3 of engine capacity;
LDVs from 2 to 3 years – GEL 1.3 per cm^3 of engine capacity;
.....
LDVs from 6 to 12 years – GEL 0.5 per cm^3 of engine capacity.

A similar differentiation is created by the Property Tax. According to the Tax Code, vehicle owners must pay annually the property tax based on the vehicle's age and engine size. The newer the vehicle, the higher the tax amount. It is obvious that the existing tax code does not stimulate the import of newer vehicles to Georgia.

However, it should be noted that in parallel with the tax legislation mentioned above, the Administrative Code imposes penalties for excessive noise and pollution levels. According to Article 80 of the Code, the "operation of transport and other vehicles that emit harmful and polluting substances or produce noise exceeding the relevant norms should be penalized by a warning or a fine in the amount of five to ten minimum wages". (Decree of the State Council of the Republic of Georgia, August 3, 1992; Law of the Republic of Georgia, March 17, 1994 "Parlamentis utskebebi", 1994, No 16, Article 308).
According to the Presidential decree No 351 "On the Minimum Wage" (dated June 4,1999), "Prior to the enactment of amendments concerning revenues, sanctions, fines and other taxes,

an amount of 1.5 minimum wages should stay in force". It is obvious, that the fines defined in this way are unrealistic and cannot solve environmental problems. It should be emphasized that not a single vehicle owner was penalized for any of the above violations during the past three years (official information of the Patrol Police).

Moreover, recent amendments to the Administrative Code increased a number of fines significantly (up to GEL500 in some cases), but these changes pertain to the violations of road traffic and safety rules, not environmental violations.

2.5 Lack of policy integration. It should be noted that although a number of institutions are responsible for the ambient air quality, the problem of air pollution in the capital of Georgia, Tbilisi, persists. The authorities responsible for the measurement of air quality are not well equipped with technical facilities. Other problems result from uncoordinated activities of the institutions, unclear definition of their competences, and unsatisfactory exchange of information among them.

- Department of Transport in the Ministry of Economic Development is responsible for the elaboration of national transport policy;
- Department for Roads in the Ministry of Economic Development - road maintenance;
- Tbilisi Municipality - responsible for spatial planning and public transport regulation in the capital;
- National Commission of Transport Regulation (currently under reform) - organization and management of the certification system in the sector, licensing body;
- Department of Patrol Police - traffic safety, vehicle registration and inspection.
- Ministry of Health is responsible for the determination of maximum permissible concentrations of pollutants in ambient air.
- Ministry of Environment is responsible for the determination of threshold values for air emissions of pollutants.

These Ministries and agencies act independently and very often the permissible emission levels for each pollutant are exceeded. None of the Ministries have an exact model of air pollution impacts on public health.

2.6 Weak public-transport system. Tbilisi used to have a well-developed public-transport system consisting of the underground, city buses, trolleybuses, tram, minibuses and taxis. Buses and trolleybuses operated regularly from the early morning until midnight. However, the system suffered from congestions in rush hours.

Following the independence in the early 1990s, the "large-bus" and "electric transport" focussed model of the Soviet period collapsed due to financial constraints. Subsequently, private operators started to complement the deficient public transport services. The use of electric transport [trolleybus (272 km), underground (27 km), and tramway (36 km)] —the most economical and more ecological means of transport— declined over the 1993–2001 time period, whereas the number of bus passengers first collapsed and is now slowly increasing. People have for the most part been drawn to the more numerous, flexible, and frequent mini-buses (see table 3). The users do complain about the bad condition of these vehicles, the poor driving habits of the operators, and the lack of cleanliness on board, but in general, service frequency, overcrowding, and the cost are the main customer concerns.

Table 3. Passenger services by transport mode

YEARS	TOTAL	OF WHICH:			
		BUS/MINIBUS	TROLLEYBUS	METRO (SUBWAY)	TRAMWAY
2000	100	64.2	4.5	28.9	2.4
2001	100	66.5	4.3	26.9	2.3
2002	100	67.1	5.5	25.8	1.6
2003	**100**	**68.5**	**4.4**	**25.9**	**1.1**
2004	**100**	**68.7**	**4.5**	**25.8**	**1.0**

Sources : *Transport and Communication in Georgia,* Statistical Yearbook, Statistics Department of Georgia, Tbilisi, 2005

Tramway transport still remains in state ownership. It suffers from the lack of new vehicles and poor maintenance of existing ones. Tram routes continue to be reduced

The subway system, however, has fared better: A number of underground stations are being renovated while the existing fleet is to be renewed to become more comfortable, attractive for passengers and energy efficient.

The Tbilisi municipality has started to improve the remaining part of the public transport system (mainly the buses) during the last 2 years. New buses were imported from the Netherlands and Ukraine with the intention to replace minibuses (one large bus can replace four or five minibuses). But this action was carried out without any study of demand for public-transport services.

There is an obvious need to develop properly a forward-looking transport-demand management and a more efficient delivery of public-transport services within the Tbilisi metropolitan region.

2.7 Public participation. Public awareness of environmental issues benefits from a supportive legal framework in Georgia. The Georgian Constitution declares free access for everybody to the environmental information. In addition, the Environmental Impact Assessment (EIA) process requires public involvement in decision-making.

It's very important to establish an effective system, which will ensure the collection of relevant information, its accessibility, encourage the sharing of information among the agencies responsible for air quality and increase level of awareness among population. the population should be informed not only about effects of harmful emissions on the environment and health, but also about the long-term impact on the climate. The public should have an access to by-laws regulating the environmental protection. This is their constitutional right. In turn, citizens should be aware of their rights and responsibilities pertaining to the environmental protection.

The problem of the factual basis for effective decision-making in Georgia is a very important one. Effective communication concerning environmental issues, through the mass media, specialized publications, accessible reporting and public participation in decision-making, is considered vital for the achievement of environmental objectives. But the information actually available mostly consists of rather crude estimations that are poorly suited to rational decision-making.

But today there are still informational white spots in key areas, due to technical, financial, and legislative inadequacies and the absence of strong material incentives to fill the gaps. For example, people in Georgia are often not aware of the public transport, traffic safety and pollution problems.

It is in the social interest to improve the road safety and environmental performance while addressing the underlying issues. This means e.g. improving the roads and road signs, the relevant information flow to the public, the enforcement of road traffic rules, and raising the awareness of road safety among both the youth and adult.

2.8. Summary of the key barriers to the development of sustainable urban transport in Georgia

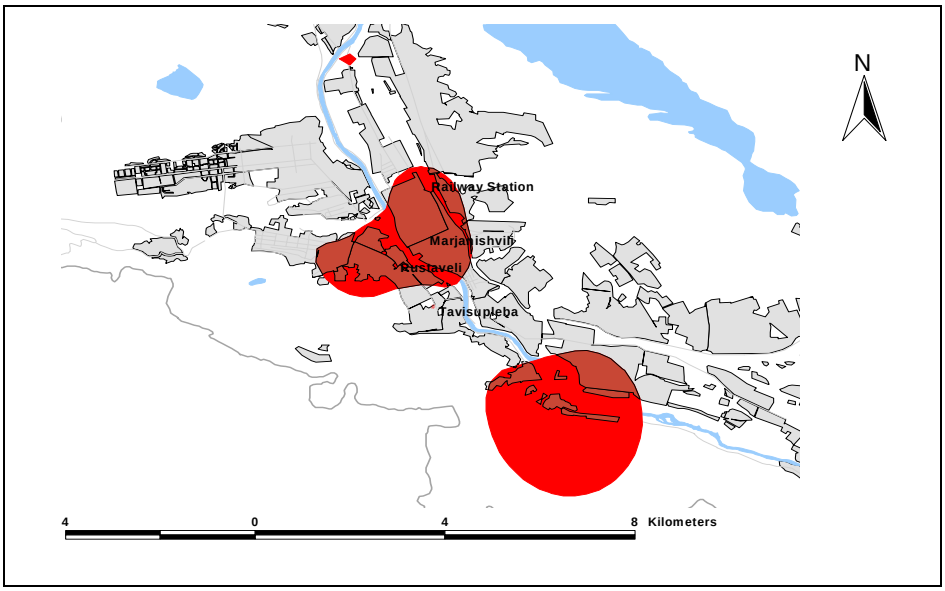
The problems of the current transport system in Tbilisi and their underlying causes can be summarised as follows:

- Lack of instruments (legal, administrative, economic) to ensure the sustainability of the system;
- Insufficient co-ordination among diverse levels of government and at the local authority level; lack of coordination of goals and tasks to improve sustainability of urban transport. Lack of integration among the three relevant sectors – Transport, Environment and Health;
- Lack of co-ordination of policies, goals and objectives, for transport, town planning, environment and health protection at the local level;
- Incoherent and weak legislation and lack of enforcement tools (to reduce transport related environment and health effects);
- Insufficient priority given to reducing the negative environmental and health effects of private car use;
- Inefficient traffic-management system and the still weak public-transport sector;
- Dysfunctional monitoring system; lack of reliable data on transport-related air pollution, lack of information on health of the exposed population;
- No control system for vehicle emissions;
- Low public awareness on the problems mentioned above;
- Low level of consultation and participation of the public and other stakeholders in the decision-making process.
- Lack of a comprehensive and forward-looking transport-demand management plan.

3. Transport-related negative health effects

From the results of the city-wide one-month diffusion tube study of Tbilisi in 2002 carried out by the experts from the Ministry of Environment of Georgia and AEA Technology, an interpolated contour plot on NO_2 concentrations was produced using the Surfer contouring software and interpolation by the method of “krigging”. In order to estimate the number of people exposed to concentrations above the EU limit value of 40μgm^{-3}, the areas enclosed within the 40μgm^{-3} interpolated contours were highlighted- see Figure 1.

Figure 1. Map highlighting areas with NO_2 concentration greater than 40µgm^{-3}



From these data, an estimate of the population that might be exposed to excessive concentrations (above the EU annual average NO_2 limit of 40 µgm^{-3}) has been derived. The underlying assumptions are that the population in the 10 districts is evenly distributed across the residential areas (i.e. only where the main areas of buildings are situated) and that the one-month annual average concentrations of NO_2 are typical of those expected over a calendar year. The results are presented in Table 4.

Table 4. Estimate of the population exposed to concentrations of NO_2 greater than 40 µgm^{-3}, by district

District	Population	Built up area (m^2)	Built up area > 40 ug/m^3 NO_2 (m^2)	Fraction of total built up area	Estimated number of people exposed
Saburtalo	146,611	6,539,310	0	0	0
Gldani	201,867	7,738,835	0	0	0
Didube	101,421	4,759,776	1,394,887	0.293	29,722
Vake	126,050	4,011,802	496,475	0.124	15,599
Nadzaladevi	204,556	8,835,621	21,550	0.002	499
Chugureti	96,032	3,413,610	1,434,389	0.420	40,352
Samgori	141,787	6,852,164	0	0	-
Isani	208,121	8,551,855	1,123,924	0.131	27,352
Mtatsminda	62,638	2,496,027	1,492,081	0.598	37,444
Krtsanisi	50,022	2,406,535	661,673	0.275	13,753
Total	1,339,105	55,605,535			164,722

Note: Although the reported numbers of exposed population are expressed in persons, it does not imply that actual estimates have been made at this level of accuracy.

The table shows that, on the basis of the data from this limited monitoring campaign, about 165 000 (11%) inhabitants of Tbilisi may well be exposed to NO_2 concentrations in excess of 40 µgm^{-3}. The estimated overall annual impact of short-term exposure to solid particles, SO_2,

NO_2 and O_3 included 450 hospital admissions due to respiratory diseases. The impact of long-term exposure to particles included 8 500 years of life lost.

Table 5 shows the estimated impact of air pollution in Tbilisi in 2002 and the estimated annual reduction (minimum-maximum) that would be achieved by meeting the EU limit values in 2005 (PM_{10} 40 µg/m^3, stage 1) and 2010 (PM_{10} 20 µg/m^3, stage 2).

Table 5. Estimated impact of air pollution in Tbilisi in 2002 and estimated annual reduction (minimum-maximum) achieved if EU limit values are met in 2005 (stage 1) and 2010 (stage 2)

Main cause	Effect	Estimated total impact in 2002	Reduction in occurrence (minimum-maximum) PM10 at stage 1	PM10 at stage 2
PM_{10}	Respiratory disease hospital admissions (number)	86	0-74	30-80
PM_{10}	Acute mortality (number)	170	0-140	58-150
O_3	Respiratory disease hospital admissions (number)	290	.....	.....
O_3	Acute mortality (number)	490	.....	.....
PM_{10}	Congestive heart failure (number)	110	0-92	38-100
PM_{10}	Cerebrovascular hospital admissions (number)	210	0-180	73-200
PM_{10}	Years of life lost due to death	8,500	0-7,300	3,000-7,900
Benzene	Acute myeloid leukemia (number)	3	2	2
SO_2	Acute mortality (number)	41	0-29	0-29
SO_2	Respiratory disease hospital admissions (number)	12	0-8	0-8
NO_2	Acute mortality (number)	150	0-71	0-71
NO_2	Respiratory disease hospital admissions (number)	62	0-30	0-30
PM_{10}	Restricted activity days	830,000	0-710,000	290,000-
PM_{10}	Ischemic heart disease	100		770,000
PM_{10}	Chronic bronchitis - adults (number)		0-87	36-95
O_3	Asthma attacks	2,000		
O_3	Minor restricted activity	12,000	0-1,700	710-1,900
CO	days	650,000	Nq	Nq
CO	Congestive heart failure (number)	340	Nq	Nq
CO	Acute mortality (number)		170 (min)	170 (min)
CO	Ischemic heart disease	7,500		
	(number)	270	3,500 (min)	3,500(min)
			140 (min)	140 (min)

Sources : The Ministry of Environment Protection and Natural Resources , AEA Technology, 2002.

According to the statistical data, the incidence of respiratory system diseases increased in Georgia as a whole, and particularly in Tbilisi. In 2003 there were 15.8% more persons with respiratory diseases than in 2002. The same trend was observed in 2004.

Table 6. Diseases of the respiratory system, policlinic support

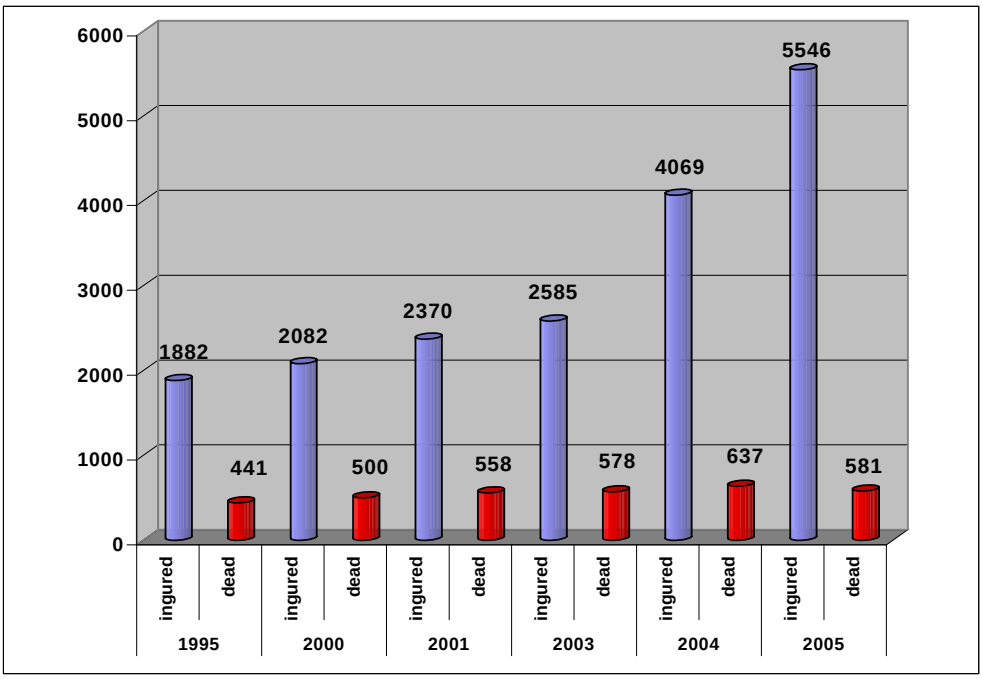
Region		Registered patients Total		Among them				First time diagnosis		
				Adults		Children 0-14 years				
		Number	Morbidity per 100000	Number	Morbidity per 100000		Morbidity per 100000	Total	Adults	Children 0-14 years
Georgia	2004	306 984	7022.3	145 173	4201.1	161 811	17 666	235 532	96 168	139 364
	2005	328 310	7510.2	151 287	4378.0	177 023	19 327	249 115	97 594	151 521
Tbilisi	2004	128 005	11833.9	43 466	4989.6	84 539	40 153.6	119 919	38 447	81 472
	2005	137 789	12738.4	45 959	5275.7	91 830	43 616.6	122 166	36 635	85 531

Sources : *Health Protection*, Statistical Data Book, Tbilisi, Ministry of Labour, Health and Social Affairs of Georgia, 2005-2006

3.1 Road fatalities and injuries

There were 3870 registered road accidents in 2005, which caused 581 deaths and 5546 injuries. Although road fatalities decreased relative to the previous year, the number of traffic accidents and injured persons kept increasing. The peak level of mortality was recorded in 2004 (637 deaths) (see figure 2). The decrease in fatalities could reflect recent measures to improve road safety conditions. The adjustments to "The Georgian Law on Traffic Safety" restricted the use of mobile phones by drivers and the use of safety belts became mandatory. It should be noted that the penalties for violations of road safety rules (high speed, drunkenness, etc.) have increased considerably. It is too early to establish a clear link between the observed reduction in deaths reported for the first time in 2005, and the new road safety regulations. The fact that in spite of a reduction in deaths, the number of injuries to road users continued to increase might suggest that stronger regulations may have played a role in reducing the severity of some accidents, but not in preventing them from occurring.

Figure 2. People killed and injured in road accidents



Sources : *Transport and Communication in Georgia,* Statistical Yearbook,
Statistic Department of Georgia, Tbilisi, 2005; Department of Patrol Police of Georgia

The alarming road safety situation in EECCA countries calls for f a strong political leadership to mobilize the relevant institutions and stakeholders, which include the transport, health, justice and education sectors as well as the private sector and civil society, towards sharing the responsibility for implementing effective preventive measures. In process of mobilization, two paradigm shifts ought to take place.
1. Road safety should become a built-in component of transport systems rather than shifting the responsibility exclusively to road users. This places more responsibility for road safety on the designers and providers of transport infrastructure, vehicles and services and requires that those planning transport systems consider that users are prone to make errors.

2. Road safety should be seen as an integral part of sustainable transport and addressed along with policies that tackle other transport-related health effects. For example, speed control not only reduces the risk and severity of road crashes but contributes to reducing emissions of noise and air pollutants and to creating conditions that are less intimidating for vulnerable road users. Although these are long-term goals that require sustained commitment over the next decades, action can be taken now without delay in implementing well-known and cost-effective measures such as reducing speed and respecting speed limits, wearing seat-belts, wearing helmets, using other safety restraints, preventing drink-driving and respecting vulnerable road users. The relatively high speed limit of 60 km/h on urban roads in Georgia and other EECCA countries should be reduced as soon as possible to 50 km/h and to 30 km/h in areas with high density of pedestrians, just like in western countries with good road-safety outcomes. The associated costs to the general government (new signs, public education campaigns, better enforcement technology) would be more than offset by comparable benefits (healthcare savings, lower income losses, etc). In addition, improving the first aid and emergency services as well as the treatment and rehabilitation of victims of injuries should receive higher priority.

Recommendations

Implementation of policies and legislation for sustainable transport is likely to be improved by a sensible realignment and coordination of incentives for the providers and consumers of transport services, involving economic instruments, monitoring, awareness raising and capacity building. Means to increase the efficiency of implementation and law-enforcement include better training of the authorities responsible for controlling violations of the environmental legislation (and the related parts of the transport and health legislation and tax code) and their stimulation through an improved appraisal system, which might include additional benefits and bonuses determined by the type of violation detected and the amount of collected fines. However, one ought to introduce at the same time the checks necessary to reduce the scope for corrupt practices. To modify the unsatisfactory (but understandable) behaviour of the providers and consumers of transport services, policymakers need to do more to assure that market prices reflect more fully external costs, including pollution. Getting the prices right is not enough, however. To improve the environmental and health effects of transport activity, public investment needs to be targeted much better than hitherto, with the aid of cost-benefit analysis and modern budgeting techniques. Last but not least, the experience of Tbilisi confirms that it is essential to improve spatial planning.

The most important preconditions for a successful implementation of the measures mentioned above are an integrated and coordinated management of environmental activities and political will. In this context, it would be effective to introduce the following innovations:

I. Improvement of transport, environment and health policy integration and institutional cooperation

The following methods would ensure a better coordination of activities of the authorities that regulate and implement transport, health, environmental and land-use policies at the national and municipal levels:

1. Agreements and Memoranda on inter-sectoral cooperation should be signed by the ministers responsible for health, environment transport and urban land-use planning. The aim of this action should be a formulation of the mechanisms and procedures to be followed in cases of overlapping interests, rights and responsibilities among the line ministries.

The joint use of the above-mentioned instruments and the implementation of the earlier described activities will increase the effectiveness of law enforcement, which should reduce air pollution and its harmful effects on the environment and human health.

2. Creation of a permanent inter-agency coordination body (Committee, Commission). This body will consist of representatives from the environmental, health and transport sectors of the central government, municipalities, business groups, trade unions and non-governmental organizations. The aim of this coordination should be the active involvement of all stakeholders in the implementation of coherent environmental and health protection policies.
There had been unsuccessful attempts to create a coordination agency.. Successful coordination might well be secured through the direct involvement of high-level government representatives (such as deputy Ministers).

3. Joint Monitoring and Inspection. This can be performed if a joint group of stakeholders exists, which should include representatives from the Ministry of Environment Protection and Natural Resources, Tbilisi Municipality, Ministry of Health, Patrol Police, Transport Department of the Ministry of Economic Development, civil society, mass media and the non-governmental sector. Joint monitoring and inspection will encourage information sharing and a broad support for the measures necessary to solve specific priority problems. For the same purpose small expert groups could be created in relevant ministries as well.

4. Institutional Strengthening

Effective collaboration among the institutions and policy integration can be encouraged by output-oriented management within the public sector. The Ministry of Environment Protection and Natural Resources and Ministry of Labor, Health and Social Welfare should protect public health by persistent actions to reduce the population's exposure to harmful air pollution, in particular from vehicle exhaust fumes. For this purpose they should:

- Set priorities for future action plans pertaining to the environmental health management;
- The Government should set up and implement a programme to ban leaded petrol, taking into account the needs of the existing car fleet (EPR recommendation).
- Develop a comprehensive environmental and health information system, and create a well organized data exchange system;
- Carry out the combined monitoring and assessment of environmental health effects (one should systematically monitor blood lead levels in children and other key indicators);
- Support the efforts of the Center for Health Statistics and the Center for Disease Control to improve the quality of health data and the relevant training programmes.

Following activities of the relevant institutions should be supported by the government:

- Preparation of a transport-demand management plan to strengthen the most environmentally friendly transport modes and technologies, encourage a more efficient use of the existing transport system, thereby reducing total demand for transport by private cars;
- Implementation, to the maximum extent possible, of all transport-demand management measures. Evaluation and monitoring of the progress in managing the demand for transport on a yearly basis;
- Improve the current air pollution monitoring system, in order to have relevant and detailed information regarding outdoor air quality situation and identify hot spots in the city;

Implement noise abatement plans and measures (monitoring), and tighten statutory limits for noise levels insensitive spaces such as schools and residential areas to minimize harmful educational and psychological effects.

- Provide opportunities for the public and other stakeholders to participate in the planning and decision-making processes of transport policy;
- Promote more environmentally friendly and safer driving behaviors, such as "eco-driving", by implementing the necessary measures, including the training of drivers. Further extend and improve the safe infrastructure for pedestrians;
- Improve road traffic safety through coordinated and effective preventive measures, legislative improvements and law - enforcement, with a particular focus on reducing speed limits in urban areas to 50 km (in line with the recommendations of the World Report on road Traffic Injury Prevention)
- Improve and extend the public transport infrastructure and services, increasing especially the number of environmentally friendly transport modes such as trolley and tram;
- Improve the delivery of public transport services while using more low-floor vehicles that are suitable for children and the disabled , and prioritize public transport in road traffic schemes;

Establish an efficient system of subsidies for sustainable public transport and provide fiscal incentives for zero or ultra-low emission vehicles (noise, pollution);

II. Shifting the demand for urban transport towards more sustainable modes

The specific geography of Tbilisi is not conducive to the operation of a large number of vehicles. In spite of this, the municipal transport policy has largely ignored one very important component of a sustainable transport system: demand management. Every effort is needed to decrease the demand for motorized transport in general and demand for private transport in particular. The Tbilisi municipality is moving in the right direction with some of its initiatives (e.g. the rehabilitation of the public bus sector), but it lacks a comprehensive transport demand management programme.

Transport demand management has four components: improvements to the transport options, market and pricing reforms, parking and land-use management, and various site-specific programmes.

1. Improvements to the Transport Options

Transport demand management is a relatively new policy instrument. One component of such programmes is an improvement of the existing transport options. This would include measures to ameliorate the current plight of pedestrians and other vulnerable road users, traffic-calming measures, and improvements to public transport. For example, improvements to the public transport system could include an integrated ticketing system, the enhanced roadworthiness and cleanliness of vehicles and safer driving . This would make public transport more attractive to current and potential users.

2. Market and Pricing Reforms

This component would include:

- Congestion pricing;
- Removing parking subsidies;
- Realignment of the excise taxes to assure that pump prices of fuel reflect its environmental impact;
- Road pricing.

3. Parking and land-use management

- Parking charges would help to improve the existing uncontrolled situation. The installation of parking ticket dispensers would help, although the initial outlays would be considerable.
- A clear designation of bus stops would also be helpful. This especially concerns mini-buses whose drivers are accustomed to stop anywhere and at any time.
- In the city centre, the existing transport activity creates a serious parking problem. A temporary solution to this problem would be to provide underground parking facilities (e.g. near the Marjanishvili Theatre, under the hotel Iveria and etc.).

A comprehensive transport demand management program (with many simultaneous measures) could reduce vehicle traffic by 20–30% (resulting in significantly less congestion, air pollution and noise, fewer road accidents and decreasing the need to build more infrastructure). Taken together, the demand-management measures would make driving private vehicles less attractive than using public transport. This transport policy alternative would entail teaching contemporary programs in transport management in educational institutions, an implementation of European “principles of environmental management”, including car-parking technology that requires less expenditures in terms of time and fuel and thus decreases harmful exhaust emissions.

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