AN IMPACT ASSESSMENT OF EMISSIONS IN THE AIR TAKING ACCOUNT FROM TRANSPORTABLE SOURCES

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The level of city ecological compatibility depends on correlation of natural and anthropogenic subsystems. However, it can be yield to qualification assessment. For the objective assessment is necessary to use quantitative data, which usually present raw data in projecting and building of cities and settlements. According to the SNR of the Republic of Kazakhstan 3.01-01-2002 cities can be divided into residential, industrial and landscape-recreational territories [1].

By some data city dispersion is about 15 million ton of dust, water steam and other toxic substances annually. That is why million of settlements on our planet are basically focuses on anthropogenic disturbance in biosphere.

Doing the concerted economical policy is impossible without credible and rapid information about condition of natural environment for the huge urban city as Almaty with the population in 1.5 million people which arranges in the region with high seismicity and torrent danger. So objective necessity in improving monitoring of existent system of city environment and creation of monitoring center in Almaty has roped. The control for the atmospheric air pollution in Almaty since 1977 year has hold on 3 stationary posts (PRS), but condition of air pollution is estimating by analysis results and by processing of air test which was chosen on these PRS. That is why during ecology-economical development of Almaty was based on strict theoretical methodology (table 1).

The first developed ecology-economical rates are initial data for the investigation and estimation of ecological situation in any settlement. This data group was not shown in literature not only in Almaty, but also in other cities too.

Scientific-practical value of developed rates will be proved in further investigations. Here we will show the general model of ecological condition in Almaty (table 2).

On the basis of this model follows that Almaty gives nothing useful to the environment, but vice-versa, selects all use and polluted it in great scales. It is in the literal sense and ecological point of view.

Table 1

Ecology-economical rates in Almaty on the beginning of 2007 year

№	Rates	Meaning of rates	Normative (rational) rates	Excess	Deficit
1	Territory, 10^3 ha., including:	31,9			
1.1	Square of green space	4,0	14,2		10,2
1.2	General square of water surface fund	1,12			
2	Population, 10^6 people, including:	1,3 (1,5)	0,8	0,7	
2.1	Economically active population:	0,650			
2.2	Learners	0,175			
2.3	Students	0,230			
2.4	Pensioners	0,360			
3	Density of population, 10^3 person/ha	40,7	25,1	15,6	
4	Average housing of population, m^2/per.	22	32-37*	–	10-15
5	Quantity of automobile, 10^3 of units	420(500)	270	150	
6	Quantity of parking places (car places), 10^3 unit	120	420	(230)	300
7	Density of auto roads with the hard surface, km/sq. km	5,3	2,4	2,9	
8	Transportation density, unit/ha	13(16)	8,5	4,5	
9	Capital repair of roads, km/year	54	130	(7,5)	76
10	Daily consumption of:				
10.1	Electricity, 10^6 kW/h	13			
10.2	Heating, 10^3 of GK	45			
10.3	Gas, 10^6 of cubic meters	1,4			
10.4	Cold water, 10^3 of cubic meters	700			
10.5	Bread, t	420			
10.6	Auto petrol and diesel fuel, kt.	3,0			
11	Passenger turnover in the public transport, 10^3 of people in a day	850	800	50	
12	Quantity of registered traffic accidents in a day	60-70	–	60-70	
13	Daily ejection of HS into environment:				
13.1	Atmosphere, t	460	–	460	
13.2	Hard domestic waste, t	1400	–	1400	
13.3	Foul water, 10^3 m^3	815	–	815	
14	Emergency call, in a time	1400	–	1400	
15	Hospitalized people, person	660	–	660	

Note: *buildings with the plastic windows;
( ) – from another city
HS-harmful substances

Table 2

Ecological model of Almaty

№	Name of component or recourse	Consumption of the city	Produces in the city	(-) Deficit, (+) Excess
1	Oxygen consumption of air basin (t), including:	115	0,7	-114,3
1.1	Inhabitants and guests	7,0		
1.2	Auto transportation	10,0		
1.3	Heat station, industrial organizations	98		
2	Using of water (m^3), including on:	700		-700
2.1	Household water needs of people	400-450		
3	Consumption of conditional food product (t),including:	3,84		-3,84
3.1	Bread	0,42		
4	Consumption of conditional fuel (t), including:	37		-37
4.1	for the auto transport	3		
5	Ejection of HS into environment (t), including:		816,86	+816,86
5.1	Into atmosphere		0,72	
5.2	Surface wastewater		815	
5.3	Hard domestic wastes		1,4	

We introduce equivalent as the land square for the visual ecological assessment. For example, for the deficit compensation in 114.3 kt oxygen we need to plant forest with square in 823 kha, but we need 700 kha of land to get 3.84 kt of conditional food product in the wheat equivalent, without accounting labour of producers such as – agricultural workers and workers for preparation food products till the final stage. Similarly we can do the same calculations on water, compensation of other types of resources which city consume. For example, raw material for the industry and building materials organizations. In addition it is necessary to have territory for the dissemination of HS(harmful substances) into atmosphere, air basin and deposit of hard waste. And we proceeded from the fact that pollution of Almaty increases in average 2-3 times of maximum allowable concentration (MAC) [2].

Summating squares of land territory and water surface fund in each index got almost 3.0 million ha of land which is necessary for independent functioning of Almaty. And it is in 94 times more than today's territory of Kazakh megapolis.

In the natural conditions the joint of sulfur and nitric oxide which dispersed to the atmosphere with the burnt gases from the auto motor are

undergo by the chemical conversion, making different acids and salts. They return back to the land by “acid” rains. Now it is proved that acid precipitation make a great harm to the atmosphere, lithosphere, hydrosphere and facilitated to the fauna destroying, make high metal corrosion and destroying of building constructions.

Bad road condition increases emission of harmful materials into atmosphere, which has extremely unpleasant influence on environment. The transport part of environment pollution increases analogical index of development countries in the world more than 1.7 times.

Substantial irregularity in the development of transport network prevents economical development of regions. About 2 thousands of villages have not year-round means of transport. Providing of settlement by regular mean make 69.3%.

That is why according to the Transport Strategy the goal up to the 2015 year is to “satisfy completely needs of economics and population in transport service”. So this will make considerable growth of auto roads’ density and radical improvement of their condition [3].

If the transport density of roads by automobile in Kazakhstan generally is not high – 16-20 units of auto on the km., so in Almaty it has 216-260 (table 3). This figures don’t account entering cars from another places, quantity of them is 55-70 thousands daily, including more than 900 local traffic buses, according to the “Almatyecologostroy”

Table 3

Transport road density in network of streets of Almaty during the 1999-2007 years (on the beginning of the year)

Characteristics	1999	2000	2001	2002	2003	2004	2005	2006	2007*
Stretch of auto roads with hard surface, km	1456,8	1457,4	1461	1461	1476,9	1489,6	1509,2	1569	1600
Density of auto roads with hard surface, km/km^2	4,8	4,9	4,9	4,9	4,9	5,0	5,0	5,2	5,3
Transport density of auto roads with hard surface, unit/km	128,2	131	161	141	177,5	158,4	192	216,7	256,3
Note: * predictable assessment (own)									

My calculation with accounting average length of auto cars – 4.2 m, buses – 11.1 m, and trucks – 7.5 which show us if we put them into

one line by bumper to bumper they would make in 2007 year 2040 km, so it exceeded length in 1.275 times of all roads in Almaty.

The length of automobile in one line is about 2286 km, which exceeds distance of auto roads with hard surface of city in 1.43 times as we take cars from other places in to consideration.

The index we have offered is a transport density of auto roads can be recommended as criteria of automobile quantity conformity to length of roads in the settlements, i.e. it can be parameter which defines transport density of cities and villages. Using its size projectors and road service can define length of roads in the projectable region or micro region. Besides that, rate of transport density we can use successfully in auto traffic modeling (in other units). Then we can consider automobile as distributive and transportable source of environment pollution taking transport-exploitation road parameter into consideration.

Further we use statement of probability theory and statistics for the calculation.

The assessment of pollutant emissions, which automobile produces rank to very difficult problem, because it depend on different factors: technical and traffic condition, structure of SRN (street-road net), quality of fuel and road surface, intensity and continuous movement of automobile, natural-climatic conditions of place and even manner of driving, as it was mentioned in the first unit.

However, this method doesn't consider automobile structure and quality of fuel. It is necessary to proceed from petrol and diesel fuel (further as fuel) quantity, which ARS (auto refueling station) realizes. These data can be more exact than traffic emission [4].

By the statistical data in Almaty in the 2006 year about 1090 thousand of ton, 60% is petrol and 40% is fuel, was realized individually by ARS or directly to major auto parks and organizations, which has treatment on fuel delivering.

The general (reduced) volume of fuel realized by ARS of Almaty was used on traffic in the city:

$$M_{пр}=M_{азс}\times P_{т.г}\ , \qquad (1)$$

Where $M_{пр}$ and $M_{азс}$ – mass of reduced fuel which was used on transportation ATS in the city and realized by ARS, t (kg);

$P_{т.г}$ - probability of fuel using in the city territory, accepted 2/3 equally.

Then:

$$M_{пр}\approx 1090\times 10^{3}\times 0{,}666= 726 \text{ thousand of ton in a year.}$$

This type of transport was neglected in the further calculation, considering small part of auto cars, which uses natural or liquefied gas.

Then this fuel density realized by automobile, driving in the city:

$$\rho_{пр} = \rho_б \times \varepsilon_б + \rho_д \times \varepsilon_д \ , \qquad (2)$$

where $\rho_б$ and $\rho_д$ – is the petrol and fuel density equal to 0.74 and 0.825 kg/m^3, respectively;

$\varepsilon_б$ and $\varepsilon_д$ – percent of consumed petrol and fuel, equally to realized by ARS 0.6 and 0.4, respectively.

From the calculation by the equation (2) $\rho_{пр}$= 0.774 kg/m^3.

The total emission of automobile which uses different types of fuel (petrol and diesel oil):

$$Q_a = M_{пр}(\varepsilon_б \times q_б + \varepsilon_д \times q_д), \qquad (3)$$

Where $q_б$ and $q_д$ – specific coefficient of harm emissions with the spent gas of car motor.

Result calculated by the equation (3) is 275.9 thousand of ton automobile emissions in 2006.

Real quantitative assessment of harmful emission from auto transport is very difficult, because many aspects are not examined yet. For example with development of scientific researches on nanotechnology the opportunity of change tens and thousand times of activity usually neutral firm substances at their crushing up to nanoquantity is revealed. Discharge gas of auto transport get to the road surface, where due to mullions-strong contact (crumbling) of wheels with complex chemical compound of asphaltic concrete was formed fine-dispersed particles [5]. What kind of chemical processes formed, what products formed, what time of their existence and what kind of danger for mankind – these questions are still unknown.

Local authorities for analyzing industrial enterprises and heat –power stations, car fleet influence on the environment may utilize the suggested ecological- economical model of Almaty, adequate decisions may be adopted as a consequence; researchers and designers may also use this model, its objective initial data for the city construction and for the street-road net (SRN) reconstruction.

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