OkrugYouth Competition of

Socially significant environmental projects

Within the frameworks of International Youth Forum

"One Planet - One Future!"

LIFE AMONG AUTOMOBILES

Russia,

Tyumen region

Khanty-Mansiysk Autonomous Okrug – Ugra

CityofLangepas

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Table of contents

1. Introduction: project justification 3

2. Basic part: project implementation
2.1. Level of load of streets and yards of Langepas city with automobile transport 5
2.2. Calculation of annual damage caused by automobile transport 9
2.3. Assessmentoflocation of pre-school educational institution next to a car parking lot 13
3. Conclusion: project performance 17
4. List of references 19
Annexes 20

Introduction: project justification

In recent decades, anthropogenic factors of the environmental pollution began to exceed the scale of the natural ones, becoming global problem. The main sources of pollution are industrial enterprises, transport, heating, industry, agriculture and others.

Existence of mankind is unconceivable without a car. When intense urbanization and the growth of megacitiestakes place, road transport has become the most adverse environmental factor in the protection of human health. Thus, a car competes for human living space. Every year the number of vehicles increases, and, consequently, the content of harmful substances in the air and soil increases, too. Permanent growth in the number of vehicles has a definite negative impact on the environment and human health. Location of children's playgrounds and kindergartens close to car parks raises special concern. This is not only our city's **problem**.

Project topic: "Life among automobiles"

Targetisto identify the potential toxic effects of transport on human health in a small town, to attract the attention of adults to the problem of placement of parking lots.

Objectives:

1. Todeterminethe level of load of streets and yards of Langepas city with automobile transport;
2. Tocalculate theoretically annual damage to atmosphere, caused by automobile transport;
3. Toassessthe impact oflocation of pre-school educational institution next to a car parking lot;
4. Topropose measures to reduce pollution from road transport in the conditions of a small city.

Object of research:damage caused by automobile transport.

Subjectofresearch: toxic effects of automobile transport in the conditions of a small city.

Methods: experimental, analytical.

The results will provide assessment of anthropogenic impact of vehicles that will attract the attention of the city's population and the administration to the problem of car parks close to kindergartens, air and soil pollution around them, and will enable real change.

Project implementation period 2013-2015.

LevelofloadofstreetsandyardsofLangepascitywithautomobiletransport

The main cause of air pollution within the boundaries of our city is the transport. The number of cars on the roads of our country is increasing from year to year at an alarming rate. Our city is not an exception. Over the past six years the number of cars in the city has increased by 1000 units. Almost every resident of the city has a passenger car or a truck, and have several cars. According to the information provided to us by the district traffic police service, today in the city of Langepasthere are 13,670 registered motor vehicles and trailers to them, of which 10,235 units are passenger cars, 2,564 units are trucks, 310 buses, 67 units of motorcycles, 299 units of trailers and 195 semi-trailers. There are 2,522 units of the vehicle registered by legal entities and 11,148 units registered by individuals. In the city of Langepasthere are 71 enterprises and organizations that have vehicles in their balance sheets, including 6,whichhave more than 50 units of vehicles (Annex 1).

Each year, hundreds of millions of tons of harmful substances enter the atmosphere with exhaust gases. They provide a harmful impact on health of people, contaminate soil and water, damage flora and fauna. But there are not essential actions aimed at minimizing the negative impact of transport in our city. This was the basis for this work.

A car consumes a huge amount of oxygen. An average car burns as much oxygen per week, as its four passengers breath during the year. 1 t of gasoline when burning produces 500 - 800 kg of harmful substances ejected into the atmosphere, annually it amounts to 5 billion tons of CO2. The exhaust gas composition includes 1,200 components, among them carbon monoxide, nitrogen oxides, hydrocarbons, aldehydes, oxides of metals (most harmful - lead oxide), carbon black.

Air pollution caused by carsis originating from three main sources: the exhaust system, lubrication system and crankcase ventilation, power supply system. The largest part (70-80%) of harmful substances emitted by motor engine is produced by exhaust gases. Combustion chamber of the engine is a kind of chemical reactor synthesizing harmful substances, which then enter the atmosphere. Even a

neutralnitrogen from the atmosphere after entering the engine combustion chamber is converted into toxic nitrogen oxide (IV).

Carbon monoxide (II) or carbon monoxide is a dangerous gas. It poisons through the respiratory tract. In lung carbon monoxide connects to hemoglobin in the blood by 200-300 times faster than oxygen. Seriously poisoned people may die from oxygen starvation. There are cases people fainted due to carbon monoxide poisoning when entering the areas of heavy traffic. It decreases the activity of enzymes of liver, heart, brain, increases blood sugar levels.

Emissions of sulfur dioxide, sulfur oxide (IV), and nitrogen oxide (IV) contribute to the emergence of respiratory diseases. Moreover, nitrogen compounds adversely effect on blood and blood vessels. They are also the cause of nitrosamines in the air - a strong carcinogen.

Alkanes, alkenes, arenas contained in the exhaust gases of vehicles cause central nervous system depression. In their interaction with nitrogen oxides under the influence of solar energy photochemical smog is produced - an unpleasant smell, visibility deteriorates, people have irritated eyes, mucous membranes of the nose, throat, exacerbation of lung diseases takes place.

Another component of automobile exhaust is lead. The use of tetraethyl lead for leaded gasoline causes emissions of about 200 thousand tons of lead annually. Lead is one of the most toxic elements on the international classification. The human body may accumulate up to 30-40% oflead, it causes a blood disease, renal failure, nervous breakdown, negative effect on protein synthesis and heredity of the organism.

We began our study with determining the loading levelof streets of the city with the heaviest traffic. Within 10 days, together with the traffic police inspectors,we carried out monitoring of the number of cars on the streets. The results are shown in the diagram (see Annex 2).

We have calculated the total workloadof streets with cars based on these observations. We counted the number of units of vehicles passing through the area for an hour (N) and calculated the total run (S), passed by all the automobiles for 1 hour according to the formula $S = N \times 1000$ m.

The results are shown in Table 1.

Table 1.Flow of automobile transport on the area of research

Type of vehicle	Number of units of vehicles (N)						Total run (S), km					
	Mira St.	Solnechnaya St.	Komsomolskaya St.	Intersection Mira-Lenine St	DruzhbyNarodov St.	Parkovaya St.	Mira St.	Solnechnaya St.	Komsomolskaya St.	Intersection Mira-Lenine St	DruzhbyNarodov St.	Parkovaya St.
Car	2,401	1,310	2,112	1,900	2,500	1,200	2,401	1,310	2,112	1,900	2,500	1,200
Truck	15	3	5	0	3	2	15	3	5	0	3	2
Bus	10	4	13	11	27	4	1 0	4	13	11	27	4
Total	2,426	1,317	2,130	1,911	2,530	1,224	2,426	1,317	2,130	1,911	2,530	1,224
Total	11, 538						11, 538 km					

AccordingtoGOST-17.2.2.03[1] the average traffic on the streets of our city is 11,538.

[1]GOST-17.2.2.03 lowtrafficintensity – 2.7-3.6 thousand vehicles per day, medium - 8-17 thousandand high - 18-27 thousand.

Calculation of the annual "damage" from a vehicles

Experts have found that one car absorbs more than 4 tons of oxygenfrom the atmosphere each year. They emit with exhaust gases approximately 800 kg of carbon monoxide (II), about 40 kg of nitrogen oxide (IV) and about 200 kg of various hydrocarbons. If we multiply these numbers to 11,538 units of cars that pass for 1 hour in the research area, which length is 5,300 m., it is possible to "calculate" the threat that hides in motorization (Table 2).

Table2.Annual "damage" fromavehicleson the research area to the atmosphere

Damage caused by cars to the atmosphere	Number of vehicles	Emissionsfor 1 year
Emissions with the exhaust gases of about 800 kg of carbon oxide (II)	11,538	9, 230, 400 kg
Emissions with the exhaust gases of about 40 kg of nitrogen oxide (IV)	11,538	461, 520 kg
Emissions with the exhaust gases of about 200 kg of various hydrocarbons	11,538	2 ,307, 600 kg
Absorbed oxygen per year– 46, 152 kg	11,538	

We calculated volume of fuel (R), burned by engines of motor vehicles according to the formula $R = S \times K$, where K is fuel consumption per 1 km in liters (Table 3). Fuel consumption for 1 km: passenger car - 0.08 -0.11 l; truck – 0.29-0.33 l; bus – 0.41 l / km. Furthermore, it is known that the fuel consumption in urban area is higher.

Table 3.Total fuel consumption on a section of roadfor 1 hour

Type of vehicle	Mira St.		Solnechnaya St.		Komsomolskaya St.		Intersection Mira-Lenina St.		DruzhbyNarodov St.		Parkovaya St.	
	Distance, km	Gasoline, L	Distance, km	Gasoline, L	Distance, km	Gasoline, L	Distance, km	Gasoline, L	Distance, km	Gasoline, L	Distance, km	Gasoline, L
Car	2,401	192	1,310	104	2,112	169	1,900	152	2,500	200	1,200	96
Truck	15	4.95	3	0.99	5	1.65	0	0	3	0.99	2	0.66
Bus	10	4,1	4	1.64	13	5.33	11	4.51	27	11.07	4	1.64
TOTAL:	2,426	201	1317	106.7	2130	176	1,911	156,5	2530	212	1,206	98.3

We calculate the amount of harmful substances emitted on a section of road on the basis of gasoline. We used the following data: it is known that during combustion of fuel needed to run 1km,0.6 liters of carbon monoxide, 0.1 liter of hydrocarbons, 0.04 liter of nitrogen dioxide evolve (Table 4).

Table 4.Volume of evolving hazardous substances

	Gasoline, L	Volume of hazardous substances		
		CO (l)	Hydrocarbons (l)	NO_2 (L)
Mira St.	201.13	120.675	20.113	8.05

Solnechnaya St.	106.71	64	10.64	4.25
Komsomolskaya St.	174.94	104.96	17.49	6.99
Intersection of Mira-Lenina St.	156.51	94	15.7	6.3
Druzhby Narodov St.	212.06	127.23	21.206	8.48
Parkovaya St.	96	57.6	9.6	3.84
Total	947.35	568.7	95	38.1

Wecalculated the mass of hazardous substances according to the formula m = M * V / Vm, where M is the molar mass; V-volume of the substance; Vm - molar volume of gas (Vm = 22 4 L / mol) (Table 5).

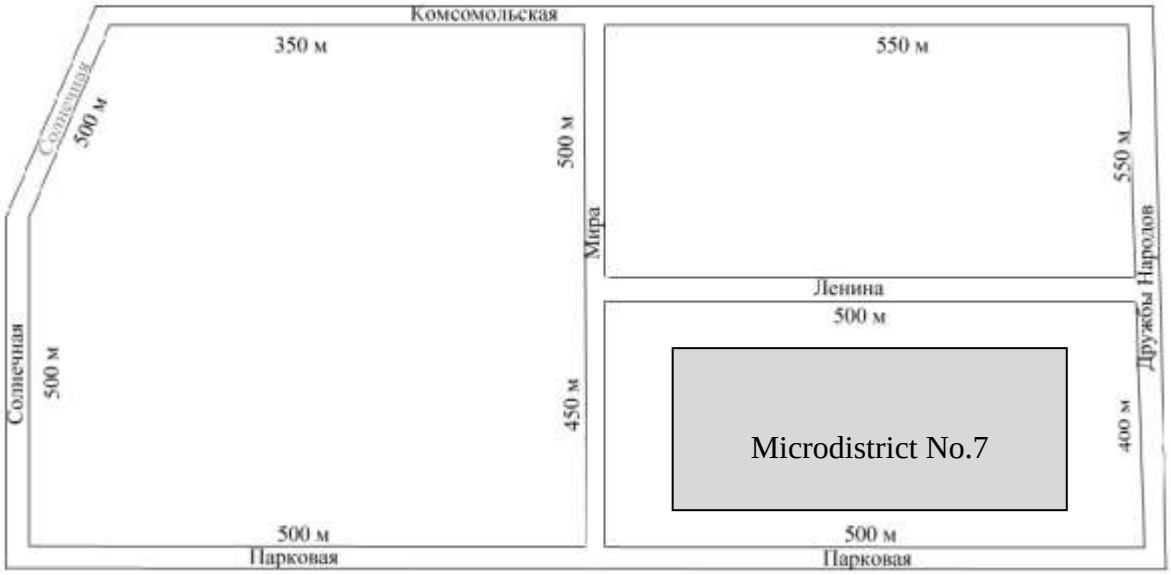
Table 5.Quantity of hazardous substances

Type of hazardous substance	Volume (l)	Weight (g)	Weight (mg)	Valueof MAC (mg/m^3)
CO	568.7	711	0.711	3.0
Hydrocarbonpentane	95	305	0.305	2.5
NO_2	38.1	78.2	0.078	0.04

Thus, the concentration of carbon monoxide and hydrocarbons (for pentane) on the test section of the road (see Figure 1), the length of which is 5300 m, does not

exceed the maximum allowable, and the concentration of nitrogen dioxide exceeded the MAC in 1,95raz.

Figure 1.Scheme of the area of research.



We calculated the amount of emitted lead on the area of researchfor 1 hour:

m (Pb) = 947.35l x 0.25 g / l = 236.84g; m (Pb) of soil = 236.84 g x 0.3 = 71g.

m (Pb) of aerosols = 236.84 g x 0.4 = 94.7 g

24.8 kg deposits in the soil, 33kg in the form of an aerosol.

Assessment of the car parking lotin the neighborhood of preschoolinstutution

In the course of research, we pay special attention to the parking lot, located at a distance of 20 meters from the kindergarten "Filippok" (Appendix 3). This parkinglot capacity is 157 units of vehicles. Parking area is 2,747.5 m2. 150 carsleave the parking lot every day. Before start, the cars are being warmed-up for 10-15 minutes. On average, each vehicle burns 0.2 liters of fuel. 25.7 liters of carbon monoxide, nitric oxide, 17.14 liters are emitted to the atmosphere (IV) (Table 6). Peak traffic in the parking lot takes place during the following time periods: 8.00-9.00,12.00 - 14.00 and 18.00-20.00. At that time children are in the playground of kindergarten and rehabilitation center.

Table6.Volume of hazardous substances produced during engine warm-up

Type of hazardous substance	Volume (l)	Weight (g)	Weight (mg)	Valueof MAC (mg/m^3)
CO	25.7	32.2	0.322	3.0
Hydrocarbonpentane	42.85	140	0.140	2.5
NO_2	17.14	39.8	0.398	0.04

Thecontentoftheproducedsubstancesintheatmospherecorrespondstothemaximumallowableconcentration.

To determine the effect of neighborhood parking lots and kindergarten, we examined the leaves of birch trees growing on the edge of the garden and parking space for the presence of heavy metal salts.

Lead ions can be detected in solution using typical reactions:

1) Lead ions form a precipitate of lead iodide of intense yellow color with iodine ions

2) Formation of a golden-yellow precipitate under the effect of chromate ion

3) blacksludgeformationundertheinfluenceofsulfideion

To determine the presence of lead in leaves, we havecollected a small amount of leaves in the kindergarten “Filippok” located near the parking lot. We took materials of equal weight. Each of them was weighed in ceramic mortar and rubbed. We added 5 ml of alcohol and water to all the samples, boiled on a spirit so lead passed in solution, then it was cooled and filtered. We prepared aqueous solution of sodium sulfide. We added one - two drops of the sample solution to the plant extract. No changes were observed, these leaves do not contain lead (Annex 4).

We added a mixture of hydrochloric and nitric acids in an amount exceeding the amount of soil in the volume 3-4 times to this dried and sieved soil. Acid extractor used for the determination in the soil of insoluble in water and saline solution components - mainly heavy metals that may be present in the soil in different forms and shapes pass into soluble form only in strong acidic medium.

The filtrate was divided into two tubes. We added potassium iodide to the first one, yellow precipitate appeared. We added sodium sulfite to the second tube and had white precipitate. The experiments show the presence of lead in soil and snow samples, taken in the kindergarten "Filippok" (Appendix 5).

It is known that about 70% of the lead added to gasoline, gets into the environment with exhaust gases, of which 30% is deposited on the ground just outside the entry to the exhaust pipe, and 40% as an aerosol mix up in accordance with the wind rose and deposited at a distance from evolve point. Highest accumulation of lead occurs in the upper part of the root layer of soil.

We calculated the amount of lead contained in the fuel, given that 1 liter of leaded gasoline contains an average of 0.25 g of tetraethyl lead. For the calculation we used data on fuel consumption in the research area: the total number of lead m(Pb) = Ql.C (Pb), where Ql - the amount of fuel burned, C - concentration of tetraethyl lead. If, during warm-up for 15 minutes a car burns gasoline of an average 200 mg, about 150 vehicles - 30 liters of gasoline per day. The total amount of lead m (Pb) = 30l x 0.25 g / l = 7.5g, Weight of lead coming into the soil immediately after the cut of the exhaust pipe m(Pb) of soil = 7.5 x 0.3 = 2.25g. (X 365 = 821g); the

amount of lead that is mixed in the form of an aerosol with wind flow m(Pb) of aerosols = 7.5 x 0.4 = 3 g (X365 = 1,095g).

Thus, 821g of lead gets in the soil in the territory of parking lot, 1,095 g of lead is moved in the form of an aerosol with wind flow.

It is known that 12 years ago, the Russian government had banned the use of leaded gasoline. But experiments showed a lead content in the soil, apparently unscrupulous dealer uses additives based on tetraethyl lead, increasing the octane number of the fuel sold in order to obtain greater profits.

Contaminated soil is one of the sources of lead for children. There is such a saying: "Lead is a disease of dirty hands". Lead disturbs hemoglobin synthesis, provokes respiratory diseases, urogenital organs, the nervous system. Lead compounds are especially dangerous for pre-school children. The children attending the kindergarten "Filippok" for more than three years (senior group), suffer from cough, asthma, acute and chronic bronchitis more often, than their peers from other preschool institutions (Table 8).

Analysis of preschool age children showed, that the main problem is the decrease of level of health of pupils, increasing the number of graduates with neurological disorders (see Table 7).

Table 7.Dynamics of the disease incidence of graduates of DOU "Filippok"

Number of graduates	Respiratory diseases	Neurological disorders
2010-2011	5	18
71	8%	25%
2011-2012	11	8
72	16%	11%
2012-2013	13	21
65	18%	32%

Table 8.Analysis of the decease incidence among graduates ofpre-school institutions of the city

Preschool Institution	Respiratory deceases		Neurological disorders	
	Number of children	%	Number of children	%
Filippok	13	18%	21	32%
Brusnichka	10	16%	18	28%
Svetlyachok	9	14%	17	25%
Rosinka	11	16%	13	20%

For the determination of lead content in the snow cover, we have taken a sample of snow in a volume of 3L in the kindergarten "Filippok". After the contents melted (melt water volume was approximately 1.5 L)we added 1 ml of 50% acetic acid and 0.5 mL of 10% dichromate solution to the sample tube. Yellow precipitate of lead settled. Snow samples taken in the kindergarten "Filippok" contain lead.

We determine the effect of lead on the activity of the amylaseenzyme. We placed 1 ml of saliva amylase extraction into two tubes. We added 1 ml of water to the 1 tube - control. We added 1 ml of meltwater, which was evaporated in order to increase the concentration of substances, to the 2 tube. The tubes were placed in a water bath at a temperature of 37^0C. A solution of iodinewas added to all tubes in 10 minutes. Coloration of control tube solution remained unchanged, confirming the splitting of starch by amylase. In the second test-tube the solution became violet color (Appendix 6). Since the substances contained in the exhaust gases, reduces the activity of amylase, which cleaves starch to glucose, which can lead to diseases of the gastrointestinal tract.

Conclusion

The number of cars in the city of Langepasfor the past six years has grown by 1,000, and currently amounts to 13, 670 units of vehicles. And it's for40,000 residents! Growth of vehicles number continues. And we inhale that was exhaled by our cars. The problem is becoming more acute.

In order to identify the potential toxic effects of transport on human health in a small town, we held registration of motor flow of one of the neighborhoods of the

city of Langepas with the most heavy traffic. The study revealed that in the area, which length is 5,300 m, over 11,538 units of vehicles pass each hour. During the year this number of cars absorbs more than 46, 000 kilograms of oxygen from the atmosphere. And with the exhaust gases, these cars produce annually more than 9,000 tons ofcarbon oxides, 460 tons of nitrogen oxide, 2,300 tonnes ofhydrocarbons and 58 kg of lead.

Calculation of the amount of precipitated hazardous substances from gasoline on the selected road segment showed that the concentration of carbon monoxide and hydrocarbons (pentane) does not exceed the maximum allowable, but the concentration of nitrogen dioxide is almost 2 times higher.

Twelve years ago, the Russian government banned the use of leaded gasoline. But experiments showed the lead presence in soil and snow cover on the territory of "Filippok" kindergarten, which is located 20 meters from the parking lot. Calculation of the amount of lead the exhaust gases based on fuel consumption showed that for the year in the car park 821g of lead settles in soil and 1,095 g of lead is moved in the form of an aerosol with wind flow. It happens in 20 meters from the nursery school!

One of the sources of lead for children is contaminated soil: lead is a disease of dirty hands. Analysis of the decease incidence among the graduates of pre-school institutions of the city revealed that children attending kindergarten "Filippok" for more than three years (senior group), suffer from cough, asthma, acute and chronic bronchitis more often, than their peers from other preschools.

A similar situation can be observed in every residential yard of our northern cities, where an area of 2.5 thousand m2 includes playground and sandpit and more than 100 units of vehicles around the perimeter (Annex 7). Usually in every yard there is a store with 2-3 trucks unloads daily. What air do we breathe? But you can prevent the entry of private vehicles into the territory of the yard! Unloading of trucks can be organized by the roadway! Parking lots shall be permittedonly outside the residential area.

These proposals have been addressed to the Department of environmental issuesof the city administration of Langepas. On May 1, 2016 Parking lot near the "Filippok" kindergarten will be closed.

List of references.

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2. GOST 19358-85 "External and internal noise of vehicles. Permissible levels and measurement methods ", Moscow," GOSTStandart, 1986

3. I.A. Korovkin, Vehicle and environment, journal "Methods of conformity assessment", No. 12, 2006

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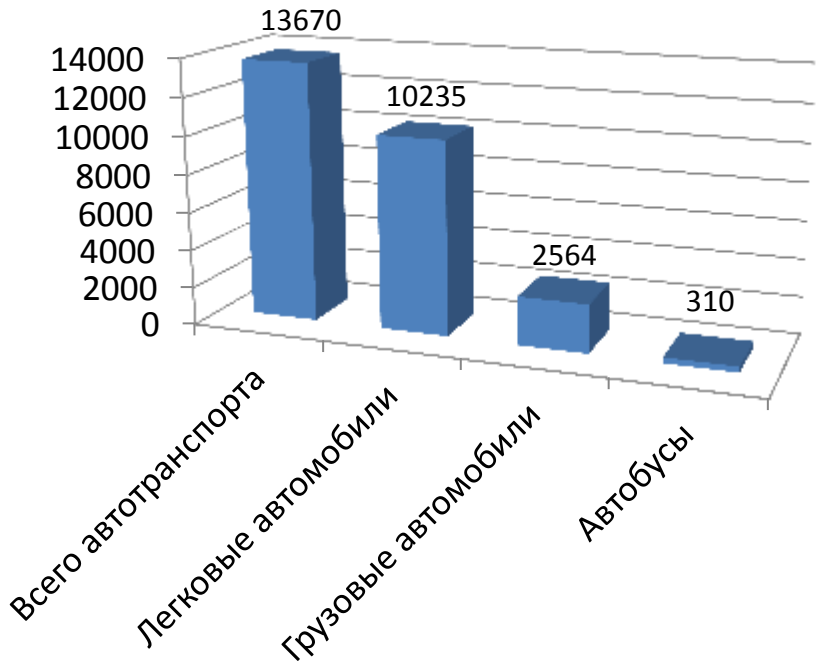
5. Internet resourceshtt: // www. Skonljne;htt: // www. krugosvet.

Annex 1

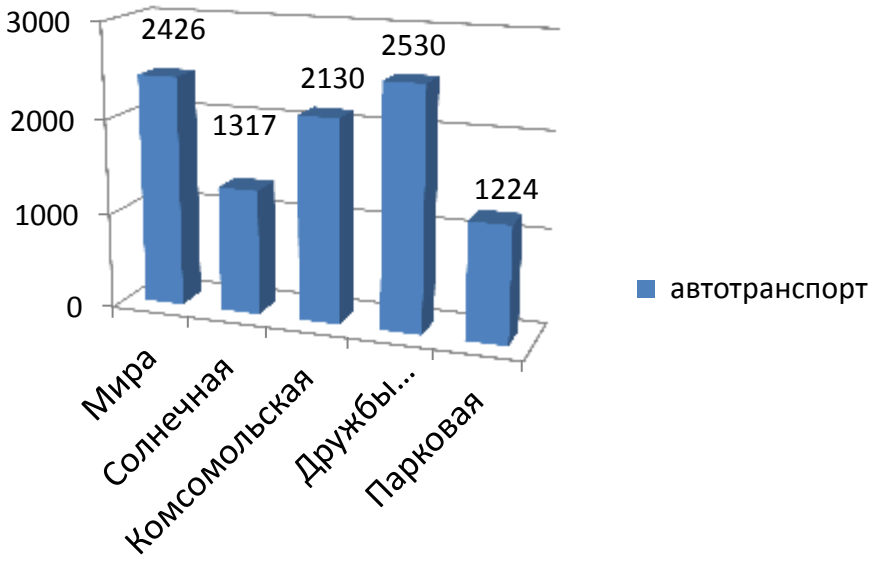
Number of vehicles in the city of Langepas



Annex 2

(Left to right: total number of vehicles, cars, trucks, buses)

LevelofloadofstreetsandyardsofLangepascitywithautomobiletranspor



Annex 3

Location of the car park next to the kindergarten "Filippok" (top view)

Location of the car park next to the kindergarten "Filippok" (photo)

Entertainment center “Anastasia”

Annex 4

Determination of heavy metals salts in plants leaves

Annex 5

Determination of heavy metals in soil and snow cover

Annex 6

Changes in the activity of saliva amylase

Annex 7

YardoftheMicrodistrictNo.7 (photo)

Sports ground in the yard (Photo)