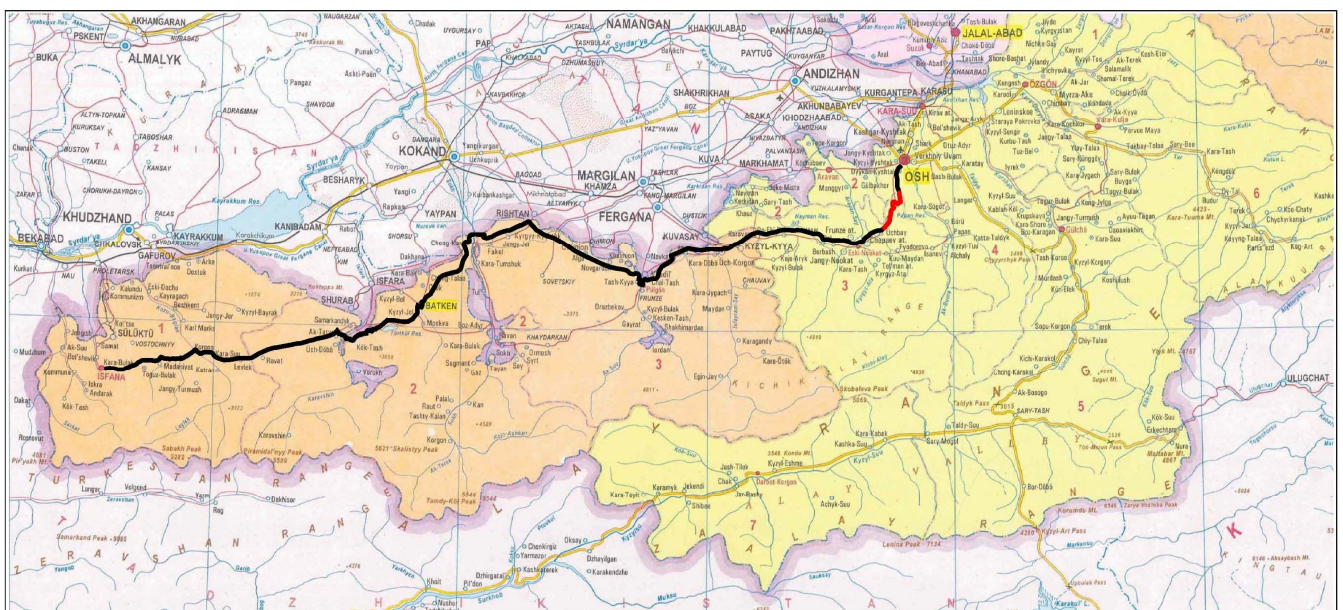




KYRGYZ REPUBLIC MINISTRY OF TRANSPORT AND COMMUNICATION

REHABILITATION OF 180 KM OF THE OSH-BATKEN-ISFANA ROAD (PHASE 1)

SECTION: KM 9+886.70 – KM 27+966



Environmental Assessment Report for Nookat Pass Section of Osh-Batken-Isfana Road

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INTRODUCTION

This is the Environmental Assessment Report for the Nookat Pass section (km 10 – 28) of the Osh-Batken-Isfana Road Project.

Natural researches and estimate of the environmental conditions in the area of the road rehabilitation at the section km 10 – km 28, were executed by the project institute "Kyrgyzdor-transproekt" in November 2008 (survey and assessment), and in July 2009 (working project) on the base of the assignment of the Ministry of Transport and Communications of the Kyrgyz Republic. An additional survey was carried out by Kocks Consult environmental expert in December 2011.

The design was worked out according to the requirements, legislation acts of the environmental preservation in force in the Kyrgyz Republic.

The main components of the ecological system such as land, subsoil, surface and subsoil water, air, flora and fauna, national monuments and social and economic conditions were considered in this project.

The project goals are as follows:

- Gathering of basic data on the environment in the area adjacent to the projected site of road;
- Assessment of the existing environmental conditions;
- Definition of the measures for weakening or removal the adverse impact of the road-building and exploitation
- Definition of impact on the environment and social consequences of project realization
- Preparation of the Applications about ecological consequences;
- Preparation of "The list of the ecological elements"

1. DESCRIPTION OF THE ROAD LOCATION DISTRICT

1.1 Climate

Climatic characteristic of the surveyed section is given in accordance with long-term observation of the meteorological station «Osh».

Absolute mark of the meteorological station «Osh» is -1016m.

Climate of the surveyed section is subtropical, with hot summer and gently cold, snowless winter, with moderate deficit of precipitations in valley part, in piedmont part with warm and even hot summer and not cold winter.

South and south-eastern winds prevail in the area of road rehabilitation.

The detailed climatic data is given in the climatic characteristic by meteorological station “Osh” (See appendix №2).

According to road-climatic division into districts of the Kyrgyz Republic territory (SNIP KR 32-01:2004, the Appendix B) the surveyed area belongs to the IV-th road-climatic zone

1.2 Location of the road and relief

The surveyed section is located in northern piedmont part of Kitchik-Alay Mountain ridge. At the section of the road km 10+000 – km 28+000 steep alluvial-proluvial piedmont aprons, uplands of piedmont type (“adyr”) and spurs of ridges on paleozoic rocks prevail.

At the section km 25 – km 26 the existing road crosses a small watershed across the low mountain spurs of the Kitchik-Alay Mountain ridge (Nookat pass).

In general the relief of the section is piedmont and low mountain, divided by dry ravines and hollows.

Absolute height marks vary from 1212,80 to 1491,40 m.

1.3 Geological structure of the soil and soil-forming rock

At the surveyed section the soils comprise typical and dark sierozems. Their thickness is 0,1-0,2m. Manual excavation group is 1 (9A) – km-km 10+750-11+250, 11+750-21+250, 21+750-27+750 and 2 (9B) – km-km 10+000-10+750, 11+250-11+750, 21+250-21+750, 27+750-28+000.

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Natural flora comprises small grass and different bushes.

Dry agriculture prevails on slopes and irrigated agriculture prevails in valley part. Cereals are cultivated on plough-lands, gardening is developed.

Slopes and shoulders of the road are partially matted by grass – 50-60%. Thickness of the vegetative layer is up to 10 cm.

1.4 Surface and subsoil waters

The largest waterway of the region is the Kirkol-Say river with its small tributaries, which is located at the distance 2.0 km westward from km 28+000. The river is elongated in submeridional direction and originates in upper parts of the Kitchik-Alay mountain ridge.

The road crosses beds of dry brooks and temporary active waterways, the most significant of them the road crosses at km 13+586, 15+350, 14+017.

The surveyed area is characterized by deep deposition of subsoil ground water. During the period of survey (November 2008) the level of subsoil water up to 4,0m of depth was not uncovered.

The surveyed section of rehabilitated road belongs to type 1 of area by character and extent of moisture (SNIP KR 32-01:2004, appendix B, table.1).

1.5 Flora and fauna

The environment of the Osh oblast has a diverse flora and fauna. Different kinds of animals and plants are concentrated in small areas, so they are very vulnerable. For preservation of biodiversity, the endangered species are registered in The Red Book.

Natural flora grows on slopes and in high-water beds and comprises motley grass, typical for southern regions. On hilly sections different kinds of bushes grow. The most diverse flora is in valleys and foothills. In spring and early summer the valleys and foothills are covered by flowers, forming picturesque landscape but in the middle of summer they dry out.

The fauna comprises rabbits, ground squirrels, wolfs and foxes.

As it was mentioned before, the environment of Osh oblast is diverse, but many species are endangered because of climate, deficit of water and use of pesticides.

So, for preservation of biodiversity, during project realization it is important to take into account vulnerability of the environment.

1.6 Social environment

The “Osh-Isfana” road is of international importance. Road km 10 - km 28 (Nookat Pass) is located within the Nookat region in the Osh oblast of the Kyrgyz Republic. This road connects two oblasts and gives the way to the territories of contiguous countries-Tajikistan and Uzbekistan.

The economy of the surveyed site is focused on agriculture and animal industry. The rural population basically lives on agriculture and trade. Cereals (mainly rice) are cultivated on plough lands, gardening is also developed.

During the nineties able-bodied citizens left for Chy valley (Bishkek city) and Russia.

During economic recession in the nineties, caused by restructuring of the economy and transition to market relations, the agricultural production sharply decreased, which in its turn, caused unemployment, and migration (mainly to Russia), mainly of the non native population. During the last years, the rural population has decreased 2-3 times. Though, now the rural population has the opportunity to compensate their loss by working for themselves.

The problems on the project road are caused by its unsatisfactory condition and maintenance and also by low traffic safety level.

1.7 Cultural-historical and architectural monuments

There are no cultural-historical and architectural monuments on the site of works and near it, so the project realization will have no impacts concerning this aspect.

1.8 Landscape

Natural landscape is considered to be a valuable factor in the inhabitant’s perception and also an important part of the ecological balance. Therefore, the need of inclusion the road into the natural landscape is of great importance. A good integration of the road into the landscape provides psychological clearness of the road for drivers, while change of landscapes on the road promotes traffic safety. The requirements for a combination of road design with natural landscape cannot be underestimated.

However, being in the surrounding landscape, the existing road does not improve the aesthetics. The road has the old asphalt-concrete surface, it is uneven, wavy.

The existing reinforced concrete culverts and bridges are in bad condition. The subgrade of the existing road has the slopes with different steepness.

Considering the above mentioned facts, the design provides for the measures, which will improve landscape of the road.

1.9 Location of quarries of construction materials, reserves of soil and water supply sources

To provide the object with construction materials it is recommended to use material of the existing quarry of pebble soil of JSC "Asfaltobeton" which is located on the left side at the distance 100m from km 7+000 of the existing road "Osh-Batken-Isfana".

Quarry of JSK "Asfaltobeton", km 7+000, 100m to the left.

Useful material comprise pebble soil with sandy aggregate. Uncovered thickness of the layer is 10-12m.

Manual excavation group is – 3 (6Б).

Subsoil water was not uncovered during the period of survey (November 2008).

The quarry may be excavated all year round

Wearing quality of material is II-2, frost resistance grade is F100.

For construction of road pavement the material is suitable only after crushing.

Reserves of soil are sufficient for rehabilitation of the surveyed section of the road.

Water for technical purposes should be taken from the Kirkol-Say River.

2. CHARACTERISTIC OF THE PROJECTED OBJECT

This project provides for rehabilitation of the road. Any serious impact on the environment is not expected because the works will be carried out on the existing road pavement and within the existing right of way. At this time, the existing road does not correspond to the normative requirements of the road with this technical category.

Rehabilitation works include dismantling of the old, destroyed layers of the pavement with full use of this material for construction of the lower layers, construction of new crushed stone base and asphaltic-concrete pavement and improvement of the drainage system. Existing culverts

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that are in good condition will be repaired and elongated; culverts in bad condition are to be reconstructed. Strengthening at inlets and outlets of culverts is also provided.

Ramps to the fields and settlements are improved; asphalt-concrete pavement is to be constructed on them.

River beds and ditches are to be strengthened. The design provides for construction of the temporary detour road and restoration works.

For traffic safety the following measures are provided:

- construction of passing places;
- construction of bridges with normative dimensions;
- placement of safety barriers;
- road marking;
- placement of road signs;

The rehabilitation of the road “Osh-Batken-Isfana” km 10 - km 28 (Nookat Pass) in accordance with Customer assignment and updated forecast of traffic volume is recommended to fulfill requirements according to the norms of a category III road.

The main technical norms (by SNiP KP 32-01:2004) accepted during projecting (for highlands) are as follows:

No	Indices	Unit of measurement	Norms	
			By SNiP KR 32-01:2004	Mountain terrain
1	Road class		III	III
2	Design speed of traffic	km\h	50	50
3	Number of lanes	pcs	2	2
4	Width of lane	m	3.5	3.5
5	Width of traffic way	m	7.0	7.0
6	Width of road bed	m	12.0	12.0
7	Width of shoulders	m	2.5	2.5
8	Width of strengthening of shoulders by type of the main road	m	0.5	0.5
9	Cross slope of the road and strengthening lane	‰	20	20
10	Cross fall of roadside	‰	40	40
11	Maximum longitudinal grade admitted in highlands	‰	80	80

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No	Indices	Unit of measurement	Norms	
			By SNiP KR 32-01:2004	Mountain terrain
12	Passing sight distance: - road surface (for stop) - oncoming car	m	75	75
		m	130	130
13	Minimal radii of curves: - in plan - in profile: a) crest b) sag	m	100	100
		m	1500	1500
		m	400	400
14	Superelevations with cross slope of the road at radii of curves in plan	m	Less than 2000	Less than 2000

Rehabilitation of the road section belongs to category III technical category, it is 18.079 km long, it is located in Nookat region of the Osh oblast.

Additional permanent land allotment for road construction is not required as the road does not exceed the limits of the existing Right of Way (RoW).

Temporary land acquisition required for quarrying and reserve is approximately 1.8 hectare.

Transport moves by one line of the rehabilitated road

The project requires a construction site (1.0 hectare) during the period of rehabilitation.

3. EVALUATION OF ENVIRONMENTAL IMPACT

Consideration of all possible consequences for the environment during the project realization in all different project stages (design, construction and operational stage) is required for definition of mitigation measures.

The objectives of the Environmental Assessment are the following:

- Description of possible, both positive, and negative influences, their scale, degree and duration of direct or indirect influence on natural and social resources, which can arise during project design, construction and operation.
- Preparation of mitigation measures to compensate adverse environmental impacts

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- Compensation of remaining impact, where mitigation is impossible, so, compensation payment is required (Social Assessment and RAP).

The evaluation of the environmental impact is conducted in 2 variants of the road condition:

- Existing condition of the road till 2028;
- Designed condition of the road till 2028;

3.1 Air

3.1.1 Air pollution

The Source of the air pollution is exhaust gases emitted from trafficking vehicles. Automobile engines not only consume a plenty of oxygen, but also pollute the atmosphere by waste gases, basically by carbon monoxide (CO), oxides of nitrogen (NOx), hydrocarbons (CmHn) and combinations of lead (Pb). Now, in the world, automobile emissions of carbonic gas CO₂ are neither normalized nor controlled, because they are nontoxic, as well as sulfurous gas SO₂, owing to its insignificant quantity in transport emissions.

Concentration of toxic substances in the air depends on the type of automobile engines (carburetor, diesel), capacities of engines, intensity of road traffic and distribution of these substances in the atmosphere. With increasing distance from the road the concentration of harmful substances in the air reduces. Concentration also depends on the direction and speed of wind and size of incoming solar radiation.

Taking into account all these factors, estimate of air pollution and level of toxic substances was made by means of the special computer program "CREDO-ECO". The program calculates concentration of harmful substances in the roadside area according to the methods of the A.I.Voejkova Head geophysical observatory (ODN- 86), considering both the volume of traffic and various dangerous wind speeds. Calculation of concentration was made for both the existing condition of the road and condition after rehabilitation. All factors (emissions, noise, pollution of ground, general toxicity) were estimated. One-time maximum *concentration limits* (MCL) were used in calculations.

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Traffic intensity	Current situation, 2008 year	Putting into operation (exploitation) 2011 year	Calculated 2028 year
Transit transport	2853	3303	7570
Total:	2853 veh/ 24 hours	3303 veh/ 24 hours	7570 veh/ 24 hours

One-time maximum concentration limits (MCL) of toxic substances in the atmosphere, accepted in CREDO, are as follows:

- Carbon oxide (CO) – 5,00 mg/m³
- Oxide of nitrogen (NO_x) – 0,085 mg/m³
- Hydrocarbons(CmHn) – 1,0 mg/m³
- Lead connections (Pb) – 0,001 mg/m³

It should be considered, that the road together with adjacent territory is already technically developed. Reports of calculations results of air pollution level are given in the Appendix 3. According to the calculations, the borders of zones of maximum concentration limits (MCL) of toxic substances in the roadside air (in meters from the traffic way) are:

The method: the Atmosphere is by OND-86. Emission is by modeling												
km	The distance from the road to the border of maximum concentration limit and noise, m											
	From the left						From the right					
	CO	NO _x	CmHn	Pb	from	Noise	CO	NO _x	CmHn	Pb	from	Noise
• KM 10 - KM 15												
• under keeping of existing condition of the road till 2028												
10-15	<4	27 - 37	<4	<4	63 - 74	<10	<4	28 - 44	<4	<4	64 - 73	<10
• under projected condition of the road till 2028												
10-15	<4	25 - 38	<4	<4	56 - 75	<10	<4	25 - 58	<4	<4	60 - 73	<10
• KM 15 - KM 20												
• under keeping of existing condition of the road till 2028												
15-20	<4	26 - 41	<4	<4	45 - 79	<10	<4	27 - 53	<4	<4	55 - 77	<10
• under projected condition of the road till 2028												
15-20	<4	25 - 44	<4	<4	43 - 75	<10	<4	25 - 52	<4	<4	53 - 77	<10
• KM 20 - KM 25												

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• under keeping of existing condition of the road till 2028												
20-25	<4	25 - 42	<4	<4	62 - 65	<10	<4	26 - 44	<4	<4	61 - 70	<10
• under projected condition of the road till 2028												
20-25	<4	24 - 28	<4	<4	57 - 70	<10	<4	24 - 42	<4	<4	58 - 72	<10
• KM 25 - KM 28												
• under keeping of existing condition of the road till 2028												
25-28	<4	26 - 46	<4	<4	61 - 77	<10	<4	26 - 54	<4	<4	54 - 74	<10
• under projected condition of the road till 2028												
25-28	<4	24 - 45	<4	<4	57 - 77	<10	<4	24 - 54	<4	<4	52 - 78	<10

Concentrations of CO in the calculated points

km 10-km 15 (under keeping of existing condition of the road till 2028)									
Calculation of concentration in calculated points at the distance 3.5,5,10,20...from the road									
Distance, m.	3.5	5	10	20	50	100	150	200	250
KM 10 – KM 15									
points to the left from the road									
U danger. m/s	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
From all sources									
CO, part of MCL	0.094	0.087	0.075	0.057	0.032	0.018	0.014	0.012	0.008
Points to the right from the road									
U danger. m/s	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
From all sources									
CO, part of MCL	0.097	0.091	0.080	0.061	0.034	0.019	0.014	0.011	0.008
km 10 – km 15 (under projected condition of the road till 2028)									
Calculation of concentration in calculated points at the distance 3.5,5,10,20...from the road									
Distance, m.	3.5	5	10	20	50	100	150	200	250
KM 10 – KM 15									
points to the left from the road									
U danger. m/s	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
From all sources									
CO, part of MCL	0.087	0.082	0.069	0.053	0.030	0.017	0.013	0.011	0.007
Points to the right from the road									
U danger. m/s	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
From all sources									
CO, part of MCL	0.090	0.086	0.074	0.057	0.031	0.017	0.012	0.010	0.008

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km 15 - km 20 (under keeping of existing condition of the road till 2028)									
Calculation of concentration in calculated points at the distance 3.5,5,10,20...from the road									
Distance, m.	3.5	5	10	20	50	100	150	200	250
km 15 - km 20									
points to the left from the road									
U danger. m/s	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
From all sources									
CO, part of MCL	0.090	0.085	0.075	0.057	0.035	0.021	0.014	0.012	0.009
Points to the right from the road									
U danger. m/s	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
From all sources									
CO, part of MCL	0.090	0.082	0.069	0.052	0.030	0.018	0.012	0.011	0.008
km 15 - km 20 (under projected condition of the road till 2028)									
Calculation of concentration in calculated points at the distance 3.5,5,10,20...from the road									
Distance, m.	3.5	5	10	20	50	100	150	200	250
km 15 - km 20									
points to the left from the road									
U danger. m/s	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
From all sources									
CO, part of MCL	0.080	0.075	0.065	0.050	0.031	0.017	0.013	0.011	0.008
Points to the right from the road									
U danger. m/s	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
From all sources									
CO, part of MCL	0.080	0.072	0.059	0.045	0.025	0.015	0.011	0.009	0.007

km 20 - km 25 (under keeping of existing condition of the road till 2028)									
Calculation of concentration in calculated points at the distance 3.5,5,10,20...from the road									
Distance, m.	3.5	5	10	20	50	100	150	200	250
km 20 - km 25									
points to the left from the road									
U danger. m/s	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
From all sources									
CO, part of MCL	0.091	0.086	0.075	0.055	0.031	0.018	0.015	0.011	0.009

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Points to the right from the road									
U danger. m/s	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
From all sources									
CO, part of MCL	0.094	0.091	0.082	0.062	0.034	0.019	0.014	0.012	0.009
км 20 – км 25 (under projected condition of the road till 2028)									
Calculation of concentration in calculated points at the distance 3.5,5,10,20...from the road									
Distance, m.	3.5	5	10	20	50	100	150	200	250
км 20 – км 25									
points to the left from the road									
U danger. m/s	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
From all sources									
CO, part of MCL	0.085	0.079	0.066	0.051	0.030	0.017	0.014	0.010	0.010
Points to the right from the road									
U danger. m/s	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
From all sources									
CO, part of MCL	0.089	0.087	0.073	0.056	0.032	0.017	0.013	0.010	0.009

км 25 - км 28 (under keeping of existing condition of the road till 2028)									
Calculation of concentration in calculated points at the distance 3.5,5,10,20...from the road									
Distance, m.	3.5	5	10	20	50	100	150	200	250
км 25 - км 28									
points to the left from the road									
U danger. m/s	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
From all sources									
CO, part of MCL	0.091	0.084	0.075	0.058	0.036	0.021	0.015	0.012	0.009
Points to the right from the road									
U danger. m/s	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
From all sources									
CO, part of MCL	0.091	0.083	0.072	0.054	0.030	0.017	0.012	0.011	0.009
км 25 - км 28 (under projected condition of the road till 2028)									
Calculation of concentration in calculated points at the distance 3.5,5,10,20...from the road									
Distance, m.	3.5	5	10	20	50	100	150	200	250
км 25 - км 28									

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points to the left from the road									
U danger. m/s	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
From all sources									
CO, part of MCL	0.085	0.078	0.065	0.050	0.030	0.018	0.013	0.011	0.008
Points to the right from the road									
U danger. m/s	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
From all sources									
CO, part of MCL	0.085	0.075	0.064	0.044	0.024	0.015	0.011	0.009	0.007

Border of MCL of NOx in the villages does not exceed the fences lines, and the border of MCL for the other toxic substances is within the limits of the road way. Within the borders of the sanitary-protective zone any exceeding of legal standards for toxic substances by 2028 is not expected. As a result the forecasted pollution indexes under the designed conditions are much better as compared to the existing road conditions.

3.1.2 Noise nuisance

Alongside with air pollution, noise becomes the adverse factor of influence on a person. The chaotic mix of sounds of various frequencies creates noise. The noise level is measured in decibels (db). Influence of traffic noise on the environment, first of all on an inhabitancy of a person, has become a global problem. Regular noise causes irritation, tiredness, sleep disturbance, raises a condition of stress. Maximum permissible level (MPL) of noise is 70 db. MPL of noise is accepted for territories adjacent to houses, kindergartens and schools, considering the following corrections:

- Noise from the traffic-10 decibel
- For the existing apartment block- 5 decibel
- During daytime from 7a.m to 23 p.m.- 10 decibel

Transport factors: volume of traffic, car fleet, speed of movement and road surface conditions have the most influence on noise level.

The vibrations arising in the paving are caused by its temporary compression under the driving vehicles and fast removal of loading. Arising fluctuations of the paving are transmitted to the ground and then to the buildings and constructions located in the roadside. Transmission of the vibration depends on kind of ground, its density, humidity, degree of uniformity and grain-size classification.

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The noise level from the road traffic, as well as from the all road-building machines and the mechanisms used for the construction of the road, is very high (within the limits of 75-90 db). The noise from bulldozers, scrapers, pneumatic hammers, vibrators and other machines is especially strong. So, the noise from scrapers makes 83-85 db, at unloading of dump-truck the noise is 82-83 db, from motor rollers it is 76-78 db. Highest noise levels occur by simultaneous work of several road-building equipments.

The traffic volume and its structure have the most impact on the noise level. The noise intensity of the traffic flow significantly exceeds the noise of a separate car. It is not only the type of engine and speed of a car that affects the noise level, but also the pavement condition and traffic organization.

Name of parameter	Symb.	Unit	Quantity	Source
km 10 - km 28 (Equivalent traffic noise under the existing road condition till 2028)				
Noise level at the distance 7,5 m. from the nearest traffic lane (without corrections)	Лтпн	Db	67.4; 67.4; 67.4; 67.4	п.4.6.5
Speed correction	DLv	Db(decibel)	-5.0; -5.2; -5.1; -5.0	т.4.6.1
Longitudinal slope correction	DLi	Db	0.0; 1.0; 0.0; 0.0	т.4.6.2
Kind of paving correction	DLd	Db	-1.5; -1.5; -1.5; -1.5	т.4.6.3
Paving evenness correction	DLp	Db	3; 3; 3; 3	т.4.6.3
Traffic structure correction	DLk	Db	-1.0; -1.0; -1.0; -1.0	т.4.6.4
Quantity of diesel vehicles correction	DLdis		2.0; 2.0; 2.0; 2.0	т.4.6.5
Coefficient, considering type of surface	Kp	Db	1.1; 1.1; 1.1; 1.1	т.4.6.7
Noise level at the distance 25 m	Лэкв	Db	59.8; 60.6; 59.7; 59.8	ф.4.6.3
Noise level at the distance 25 m	Лэкв	Db	56.6; 57.5; 56.5; 56.6	ф.4.6.3
Noise level at the distance 50 m	Лэкв	Db	53.4; 54.3; 56.5; 56.6	ф.4.6.3
Noise level at the distance 100 m	Лэкв	Db	50.2; 51.1; 50.1; 50.2	ф.4.6.3
Noise level at the distance 200 m	Лэкв	Db	48.1; 49.0; 48.0; 48.1	ф.4.6.3
Noise level at the distance 300 m	Лэкв	Db	45.7; 46.6; 45.6; 45.7	ф.4.6.3
Noise level at the distance 500 m	Лэкв	Db	42.4; 43.3; 42.3; 42.4	ф.4.6.3
km 10 - km 28 (Equivalent traffic noise under the designed condition of the road till 2028)				
Noise level at the distance 7,5 m. from the nearest traffic lane (without corrections)	Лтпн	Db	67.4; 67.4; 67.4; 67.4	п.4.6.5
Speed correction	DLv	Db	-4.6; -4.7; -4.7; -4.6	т.4.6.1
Longitudinal slope correction	DLi	Db	0.0; 1.0; 0.0; 0.0	т.4.6.2
Kind of paving correction	DLd	Db	-1.5; -1.5; -1.5; -1.5	т.4.6.3
Paving evenness correction	DLp	Db	1; 1; 1; 1	т.4.6.3

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Name of parameter	Symb.	Unit	Quantity	Source
Traffic structure correction	DLk	Db	-1.0; -1.0; -1.0; -1.0;	Т.4.6.4
Quantity of diesel vehicles corrections	DLdis		2.0; 2.0; 2.0; 2.0	Т.4.6.5
Coefficient, considering type of surface	Kp	Db	1.1; 1.1; 1.1; 1.1	Т.4.6.7
Noise level at the distance 25 m	ЛЭКВ	Db	58.2; 59.1; 58.1; 58.2	Ф.4.6.3
Noise level at the distance 25 m	ЛЭКВ	Db	55.0; 56.0; 54.9; 55.0	Ф.4.6.3
Noise level at the distance 50 m	ЛЭКВ	Db	51.8; 52.8; 51.7; 51.8	Ф.4.6.3
Noise level at the distance 100 m	ЛЭКВ	Db	48.6; 49.6; 48.5; 48.6	Ф.4.6.3
Noise level at the distance 200 m	ЛЭКВ	Db	46.5; 47.5; 46.4; 46.5	Ф.4.6.3
Noise level at the distance 300 m	ЛЭКВ	Db	44.1; 45.1; 44.0; 44.1	Ф.4.6.3
Noise level at the distance 500 m	ЛЭКВ	Db	40.8; 41.8; 40.7; 40.8	Ф.4.6.3

Noise level in the villages along the road does not exceed the norm. At that, noise indexes under the designed conditions are better than under keeping of the existing condition of the road (Noise level will decrease after road rehabilitation).

3.2 Surface and subsoil waters

Pollution of surface waters may occur as a result of industrial and household waste discharge, penetration of chemical and mechanical pollutants from the road into water. Pollution of subsoil waters may occur owing to filtration of drains from the surface of the ground, as well as due to discharge of sewage without treatment from the roads to underground horizons.

Among the widespread water pollutants, the most concern causes the penetration of oil products into water. The first signs, separate color spots, appear already at spillage of 4 ml/m². Maximum concentration limit for oil and mineral oil is 0.1-0.3 mg/l.

The design considers suitable measures for prevention of penetration of pollutants into the rivers. On the designed bridges, water flow from the bridge road goes along the barrier curbs to the metal ditches, then it flows to the special street inlet (concrete box), filled by filter materials. So, everyday and industrial waste water, as well as chemical and mechanical pollutants, can not penetrate in the river.

There is no subsoil water in the place of the road location. So, pollution of surface water will not occur.

The design provides for use of water for technical and household needs during the road rehabilitation. Haulage of water to the places of consumption (the road, camp of the builders, etc.) is provided in tank-trucks. Technical and drinking water must be transported separately. Water must be taken from places, approved by the authorities of the Batken oblast.

3.3 Soil erosion and pollution

The complex of technological processes, connected with the road construction, usually provokes largest impacts. Pollution of the top-soil is observed on the temporarily occupied areas, as well as on the projected road.

Pollution of the ground occurs mainly due to falling out of fine dispersed and flour particles, carried by car wheels from roads and passages with an unimproved surface, partial losses of transported bulk cargoes, rubbing surface of tires, and toxic components of the exhausted gases of cars.

Soil pollution alongside the road occurs due to accumulation of lead, contained in the exhausted gases, in the soil. About 80% of lead, containing in the exhausted gases, penetrates into the ground. It is necessary to consider the stability of lead in the soil and its intensive accumulation in vegetation with the following transition to animals and to a person. In a roadside area, about 50% of lead emissions in the form of micro particles, immediately spread on the surface of the adjoining territory.

Calculation of lead content in the soil of the roadside was made by the program "CREDO" The program complex of engineering researches, digital modeling of the area. Genplans and roads designing. Designing of ecological measures"

Deposit of lead on the surface (ϕ.4.2.2) and soil pollution (ϕ.4.2.1) on the left from the road

km 10 - km 28 (concentration of pollutants under the existing condition of the road till 2028)								
Distance(m) from the edge of the road	10	20	40	60	80	100	150	200
Deposit of lead for 20 years, g/m ²	2.4; 2.3; 2.2; 2.1	0.49; 0.47; 0.44; 0.42	0.19; 0.19; 0.18; 0.17	0.10; 0.09; 0.09; 0.08	0.05; 0.05; 0.04; 0.04	0.02; 0.02; 0.02; 0.02	0.00; 0.00; 0.00; 0.00	0.00; 0.00; 0.00; 0.00
Pollution of soil by lead, mg/kg	7.6; 7.3; 6.9; 6.5	1.52; 1.47; 1.38; 1.30	0.61; 0.59; 0.55; 0.52	0.30; 0.29; 0.28; 0.26	0.15; 0.15; 0.14; 0.13	0.08; 0.07; 0.07; 0.07	0.02; 0.01; 0.01; 0.01	0.00; 0.00; 0.00; 0.00

Deposit of lead on the surface (ϕ.4.2.2) and soil pollution (ϕ.4.2.1) on the left from the road

km 10 - km 28 (concentration of pollutants under the designed condition of the road till 2028)								
Distance(m) from the edge of the road	10	20	40	60	80	100	150	200
Deposit of lead for 20 years, g/m ²	2.1; 1.8; 1.6; 2.1	0.43; 0.35; 0.32; 0.41	0.17; 0.14; 0.13; 0.17	0.09; 0.07; 0.06; 0.08	0.04; 0.04; 0.03; 0.04	0.02; 0.02; 0.02; 0.02	0.00; 0.00; 0.00; 0.00	0.00; 0.00; 0.00; 0.00
Pollution of soil by lead, mg/kg	6.7; 5.5; 5.0; 6.5	1.34; 1.09; 1.00; 1.30	0.54; 0.44; 0.40; 0.52	0.27; 0.22; 0.20; 0.26	0.13; 0.11; 0.10; 0.13	0.07; 0.05; 0.05; 0.06	0.01; 0.01; 0.01; 0.01	0.00; 0.00; 0.00; 0.00

From the results of calculation we can conclude, that by the year 2028 of the roads operation, the maximum concentration limit of lead in the roadside ground (32 mg/kg) will not exceed the limits of the roadbed. At that time, the indexes of pollution by lead under the designed condition of the road are better than the indexes of pollution by lead under the existing condition of the road.

Soil pollution outside the roadbed will not exceed maximum - concentration limit.

Soil erosion is improbable due to the road rehabilitation, as all drainage constructions are strengthened by concrete and other waterproof materials.

Some soil erosion may arise on the sites of building materials extraction, but this erosion is limited and temporary and has small influence, as the sites are located on the invaluable grounds for agricultural use.

Soil pollution may also occur during the road-building period as a result of combustive-lubricating materials, fuel, or bitumen spilling. It is supposed, that this effect will be minimal and only within the road way and on temporarily used grounds.

3.4 Subsoil

The road rehabilitation has the most significant impact on the ground resources. During all project stages the ecological requirements for soils, stipulated by the legislation on environmental protection should be observed. First of all, rational and complex use of subsoil resources should be provided. Saving of the ground surface, due to special methods of field development, prevention of technogenic ground desertification, erosions of all kinds, contamination of surface and subsoil waters, accessway dumps, their corrosion and spontaneous ignition, abandonment of combustive-lubricating materials and leavings of production works, should be also guaranteed.

The adverse impact on subsoil during the road rehabilitation may occur as a result of excavation of building materials in the gravel and sand deposits. The roadway and the road constructions have limited impact on the subsoil.

3.5 The impact on flora and fauna

Considering the fact of the roads existence for a long period of time before the beginning of the rehabilitation and the way of fauna's life in adjoining territory, the influence of the road rehabilitation on the flora and fauna will be insignificant.

Nevertheless it is necessary to note the following: Harmful consequences for vegetation, including trees, arise as a result of transport emissions. Experts have established the impact of various kinds of pollution causing destruction of pigments, suppression of protein synthesis, enzymes and other functions of plants. All these factors lead to disturbance of growth and development, acceleration of aging process, especially for perennial plants.

Moreover, it is necessary to consider the ability of many plants to accumulate heavy metals, polluting the ground. Pollution of the ground surface and vegetation by transport emissions occurs gradually and it directly depends on the distance to the traffic way.

It is necessary to note the number of factors, that have adverse impact on fauna: these factors are: blocking natural migration of species to places of temporary and permanent habitats, impact on the gene pool due to disruption of migration corridors, reproduction etc. These factors are the elements of the road design: slopes, embankments, excavations, enclosures and the traffic way itself. The factors causing frightening of animals and disturbing their habitats are: noise, vibration, artificial light. As it is known, animals' reaction to the disturbing factors may be different. Under the influence of gas pollution, noise and vibration, mutation of animal species happens in the wayside territory. Cases of genetic mutations of insects and rodents, living alongside roads, are also noted.

As a result of the wayside pollution by heavy metals, salts and other harmful substances, the vegetation, eaten by animals and birds, may cause poisoning and death of various representatives of fauna.

Representatives of the fauna may be knocked down by passing transport. All these factors decrease the number of population.

Insignificant adverse impact of rehabilitation happen only during construction period as a result of casual driving of building machines outside the site (km243) and illegal actions of people in relation to animals and plants (shooting of wild animals, cutting down of trees, etc.).

All actions for the road rehabilitation are carried out within the existing Right of Way, allotted for constant and temporary use, and cannot significantly influence flora and fauna.

The design provides for forced cutting down of some trees, stumps and clearing the territory from bushes.

3.6 Social environment

In spite of the adverse impact of the road on the environment, the project realization as a whole has beneficial effects for life support and social economic development of the population.

As a result of the road rehabilitation, quality of services for population will significantly increase.

A man suffers from automobile exhausts most of all, however, understanding all benefits from a vehicle (the almost single kind of transportation at the present time), people don't protest against it. The most dangerous pollutants are burnt gases. The other negative factors comprise noise and vibrations.

Influence of the rehabilitation processes will take place only for a short period of time; however, accidents may happen as a result of bad condition of the road.

The influence on the social environment will be positive.

During the rehabilitation period there will be lot of vacancies for workers, including local residents, who will be able to take part in construction works.

The rehabilitation of the road will significantly improve transport conditions for the local population and increase the safety of traffic movement.

This, in its turn, will lead to an improvement of social conditions of the population in the area of the road

3.7 Cultural-historical and architectural monuments

As it was noted in Chapter 1, there are no cultural-historic and architectural monuments in the area of rehabilitation works.

3.8 Land recourses

The existing road is located in Nookat region, Osh oblast.

As a result of long usage of the road without repairing works, the road does not correspond to the transport-operation requirements of the road of this category. Additional land resources are required to make the existing road corresponding to the parameters of the 3-rd category of the road.

It is provided to use the occupied land resources. For the road rehabilitation the right of way will be used.

Taking the agricultural land for the construction purposes is the main factor of the road influence on the environment.

Considering the requirements of the land laws, the main requirement is restoration of the land. The technology, order and volume of the restoration works are given in the corresponding part of this project.

Temporary land acquisition was approved by the land bodies and environmental preservation agencies at the stage of survey.

3.9 Traffic safety

Road accidents may happen during road operation (to a greater extent) and during the construction stage (in much less extent). There are negative factors of the existing road influencing the environment and human life.

Standards and rules, accepted for the road construction, as well as the road condition and methods of traffic control increase the safety of traffic and decrease the accidents.

Bad condition, pot-holes and surface irregularities of paving increase the risk of accident. At present time the traffic control occurs only by means of traffic signs, there is no necessary furniture on the road. Traffic signs give incomplete information on the road.

After rehabilitation, safety conditions will correspond to the road category and type of the area.

4. MEASURES FOR MITIGATING THE ADVERSE IMPACTS OF THE ROAD AND ITS TRAFFIC ON THE ENVIRONMENT

During the road rehabilitation it is necessary to consider not only technical and economic characteristics but also the roads impact on the environment and integration of the road into the landscape by preferring the decisions which as little as possible affect the environment. It is also necessary to consider the legislation related to environmental protection and preservation during project design, construction and operation.

The rules of preserving of natural landscapes, forests, flora and fauna also should be considered.

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The environmental impacts occur during the execution of most technological processes connected with rehabilitation of roads, as well as during aggregate extraction and preparation of road-building materials, e.g. operation of asphalt plant. It is necessary to note, that pollution of the environment during works is temporary and continues only during technological works. Therefore, despite their high intensity, it is better to prevent consequences of their effect on the environment.

Despite the fact that the road rehabilitation project has very insignificant adverse impact on the environment, the project stipulates different measures and requirements to the contractor and to the customer, in order to avoid or mitigate potentially adverse impacts. Monitoring and control of implementation maintenance of the mitigation measures must be made by the customer of the project together with State services for ecology and preservation of the environment (area, region). Such work should be carried out at the stage of contractor selection during tendering process. Moreover during the road operation the project customer must observe the PE (protection of the environment) condition of the road.

The essential part of the contract documents at the formation of the contract with the Contractor must be the "Preservation of the environment" section.

The contractor should place the highest emphasis to the environment, observe the project requirements and carry out the actions, concerning protection of the environment, develop and coordinate with the state bodies on ecology and preservation of the environment the project of works and the "Preservation of the environment" section and undeviatingly observe their execution

4.1 Measures for mitigation of adverse impact on the air

During the construction works the Contractor is obliged to execute the following requirements in order to mitigate the impact on the air:

- The Contractor organizes methods of execution in order to minimize dust and pollution emissions.
- The contractor uses effective spraying machines for production and delivery of bulk materials (sand, crushed stones, etc.) and for moistening of stored bulk materials in dry and windy weather.

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- During transportation of dusty materials in bodies of cars, the material must not be loaded above the sides of the car and must be covered by a clean tarpaulin in a good condition.
- Temporary roads with soil or gravel surface for the construction materials transportation should be constantly (several times during the day) moistened during dry weather.
- The asphalt plant must be equipped by modern cleaning constructions and filters for catching firm particles (dust and soot) from the system of the heat-carrier and must be located at a distance not less than 0,5 km from open water reservoirs and centers of population.
- Building transport and building machines should be kept in good working condition. Reduction of vibrations depends on technical condition of the machines. During work it is necessary to observe the operating mode of the vibrating machines which vibration should correspond to the sanitary norm. At that two regulated breaks are recommended. The maximum allowable level of transport-technological and technological vibration of workplaces must correspond to the requirements of the Health Ministry of the Kyrgyz Republic.
- The contractor must take the adequate measures for restriction of exhaust gases emissions from engines of building machines and equipment, and include the description of these preventive measures in his plan for mitigation and control the impacts on the environment.

As it was mentioned above, no significant impacts on the air during road construction and operation are expected. The following measures, providing safe movement, reduce the extent of air pollution by exhausted gases:

- Building of new asphalt carpet with even surface (IRI <2.5).
- Increasing of the width of the carriageway.
- Construction of speed change lanes.
- Strengthening of shoulders by gravel-sand mix with optimal grain-size composition.
- Equipping of the road with signs, road marking and safety fences, which provides safe movement for cars with steady engine work .

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Emissions of harmful substances to the atmosphere during works by road-building machines and mechanisms were defined by the following formula, developed by MADI:

$$Pi = Mi \times Ri \text{ ton/year}$$

Where: Pi - year emissions, t/ year
 Mi - specific emissions of toxic substances at tones per tone of consumed fuel.
 Ri - consumption of the fuel by transport and road-building machines, t/year

Specific emissions of toxic substances during the work of road-building machines and mechanisms

No	Name of emissions	Sign	Unit	Emissions of engines	
				Carburetor	Diesel
1	Oxide of carbon	CO ₂	ton	0.07	0.01
2	Hydrocarbons	CH	ton	0.1	0.03
3	Nitrogen dioxide	NO ₂	ton	0.04	0.04
4	Soot	C	ton	0.005	0.05
5	Sulfurous anhydride	SO ₂	ton	0.002	0.02

**Fuel consumption for the road rehabilitation period
(road-building machines and mechanisms)**

№ № п.п	Source of harmful emissions	Kind of fuel	Fuel consumption Kg/h	Time of mechanism work m/h	Fuel consumption Ton
1	Watering machine ZIL-130, 6000 l	petrol	22	4000	88.000
2	Motor graders 99 kwт	diesel fuel	11	3760	41.360
3	Pavers 7000l	diesel fuel	20	960	19.200
4	Asphalt pavers	diesel fuel	14	960	13.440
5	Bulldozers 108 hp., 130 hp. 165 hp.	diesel fuel	8	480	3.840
6	Motor rollers 8t, 13t, 16t.	diesel fuel	13	960	12.480
7	Automotive-type cranes 6.3 t, 10t.	diesel fuel	14	480	6.720
8	Caterpillar cranes 16 t, 25t.	diesel fuel	14	480	6.720
9	Rubber-tire cranes 25t.	diesel fuel	10	400	4.000

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№ № п.п	Source of harmful emissions	Kind of fuel	Fuel consumption Kg/h	Time of mechanism work m/h	Fuel consumption Ton
10	Marking machine T-40	diesel fuel	11	320	3.520
11	Tractor 108 hp.	diesel fuel	8	400	3.200
12	Tractor 80 hp.	diesel fuel	3.7	400	1.480
13	Excavators	diesel fuel	6.2	1040	6.448
TOTAL FOR THE REHABILITATION PERIOD		Diesel fuel	122.408		
		Petrol	88.000		

**Calculation of exhaust gases during machines and mechanisms work
for the road rehabilitation period**

№ п.п	Source of harmful emissions	Kind of fuel	Fuel consumption, ton	Emissions for the rehabilitation period, ton.				
				CO ₂	CH	NO ₂	C	SO ₂
	<i>Specific emissions of fuel, ton</i>	<i>Diesel fuel Petrol</i>	-	<i>0.01 0.07</i>	<i>0.03 0.10</i>	<i>0.04 0.04</i>	<i>0.05 0.005</i>	<i>0.02 0.002</i>
1	Watering machine ZIL-130, 6000 l	petrol	88.000	6.1600	8.8000	3.5200	0.4400	0.1760
2	Motor graders 99 kwt	Diesel fuel	41.360	0.4136	1.2408	1.6544	2.0680	0.8272
3	Pavers 7000 l	Diesel fuel	19.200	0.1920	0.5760	0.7680	0.9600	0.3840
4	Asphalt pavers	Diesel fuel	13.440	0.1344	0.4032	0.5376	0.6720	0.2688
5	Bulldozers 108 hp., 130 hp. 165 hp.	Diesel fuel	3.840	0.0384	0.1152	0.1536	0.1920	0.0768
6	Motor rollers 8t, 13t, 16t.	Diesel fuel	12.480	0.1248	0.3744	0.4992	0.6240	0.2496
7	Automotive-type cranes 6.3 t, 10t.	Diesel fuel	6.7200	0.0672	0.2016	0.2688	0.3360	0.1344
8	Caterpillar cranes 16 t, 25t.	Diesel fuel	6.7200	0.0672	0.2016	0.2688	0.3360	0.1344
9	Rubber-tire cranes 25t.	Diesel fuel	4.000	0.0400	0.1200	0.1600	0.2000	0.0800
10	Marking machine T-40	Diesel fuel	3.520	0.0325	0.0975	0.1300	0.1625	0.0650
11	Tractor 108 hp.	Diesel fuel	3.200	0.0320	0.0960	0.1280	0.1600	0.0640
12	Tractor 80 hp.	Diesel fuel	1.480	0.0148	0.0444	0.0592	0.0740	0.0296

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№ п.п	Source of harmful emissions	Kind of fuel	Fuel consumption, ton	Emissions for the rehabilitation period, ton.				
				CO ₂	CH	NO ₂	C	SO ₂
13	Excavators	Diesel fuel	6.448	0.0644	0.1934	0.2579	0.3234	0.1289
Total for the rehabilitation period		<i>Diesel fuel</i>	122.408	1.2213	3.6641	4.8855	6.1069	2.4427
		<i>Petrol</i>	88.000	6.1600	8.8000	3.5200	0.4400	0.1760
TOTAL emissions from petrol and diesel fuel burning during the period of rehabilitation, ton				7.3813	12.4641	8.4055	6.5469	2.6187
Total for the rehabilitation period, ton		37.4165						

Calculation of dust emission during taking- out-loading works

"Methodical aid for calculation of emissions from unorganized sources in building materials industry" (SOUZSTROMEKOLOGIA 1989 year.)

Name of soil	P1	P2	P3	P4	P5	P6	B	G	r/c
Crushed stone	0.04	0.02	1.2	0.7	0.4	1.0	0.5	26.1	0.974
GSM	0.05	0.03	1.2	0.7	0.4	1.0	0.5	49.2	3.444

Calculation is made by the following equation (8):

$$Q=P1*P2*P3*P4*P4*P5*P6*B'*G*106/3600=g/sec,$$

- Where:
- P1 - coefficient of party of dust fraction weight in the layer (table 1-4)
 - P2 - coefficient of party weight crossing to aerosol (table 1-5)
 - P3 - coefficient depending on wind speed (table 2)
 - P4 - coefficient depending on material humidity (table 4)
 - P5 - coefficient, dependent on material size (table 5)
 - P6 - coefficient, dependent on local conditions (table 3)
 - B' - coefficient, dependent on discharge height (table 7)
 - G - quantity of rock, processed by excavator t/h

Calculation of the dust emissions during motor transport works

"Methodical aid for calculation of emissions from unorganized sources in building materials industry" SOUZSTROMEKOLOGIA 1989 year.)

Material	C1	C2	C3	C4	C5	C6	C7	N	L	q ₁	F ₀	n	q ₂	г/с
Crushed stone	1.3	1.5	0.5	1.4	1.2	0.7	0.01	6	10	1450	12	6	0.002	0.3342
Sandy gravel and other.	1.3	1.5	0.5	1.4	1.2	0.7	0.01	6	10	1450	12	6	0.002	0.3342

CALCULATION IS MADE BY THE FOLLOWING EQUATION (7):

$$Q = \frac{C_1 \times C_2 \times C_3 \times N \times L \times q_1 \times C_6 \times C_7}{3600} + C_4 \times C_5 \times C_6 \times q_2 \times F_0 \times n, \text{ г/сек}$$

- where:
- C1 – coefficient, considering the average freight transport capacity (table 9)
 - C2 – coefficient, considering the average transport speed (table 10)
 $V_{cp} = N \times L / n$, km/h
 - C3 – coefficient, considering the road condition (table 11)
 - C4 – coefficient, considering surface profile of materials in the body
 F_{fact} / F_0
 - C5 – coefficient, considering , blowing speed of the material in the body (table 12)
 - C6 – coefficient, considering humidity of the surface layer of the material (table 4)
 - C7 – coefficient, considering part of dust lost in the air - 0,01
 - N – a number of motions (there and back) of the all transport per an hour
 - q1 – dust emission in the air for 1 km of haul – 1450g
 - q2 – dust emission in the air from the actual surface unit of the material on the decking (table 6)
 - n – the number of dump-trucks, working in the quarries

Calculation of dust emissions during earth works and paving construction

"Methodical aid for calculation of emissions from unorganized sources in building materials industry" (SOUZSTROMEKOLOGIA 1989 year.)

Name of works	k1	k2	k3	k4	k5	k7	B'	G	r/c
Unloading of crushed stone	0.04	0.02	1.2	1.0	0.7	0.4	0.5	26.1	0.9744
Distribution of crushed stone	0.04	0.02	1.2	1.0	0.7	0.4	0.4	26.1	0.7795
Unloading of Sandy-gravel and others	0.04	0.02	1.2	1.0	0.7	0.4	0.5	49.2	1.8368
Distribution of Sandy gravel and others	0.04	0.02	1.2	1.0	0.7	0.4	0.4	49.2	1.4694

The calculation is made by the following equation (2):

$$Q = \frac{k_1 \times k_2 \times k_3 \times k_4 \times k_5 \times k_7 \times B' \times G \times 10^6}{3600}, \text{ g/sec}$$

- Where :
- k1 – coefficient of party of dust fraction weight in the layer (table 1-4)
 - k2 – coefficient of party weight crossing to aerosol (table 1-5)
 - k3 – coefficient dependent on wind speed (table 2)
 - k4 – coefficient dependent on local conditions (table 3)
 - k5 – coefficient, considering humidity of the surface layer of the material (table 4)
 - k7 – coefficient dependent on material size (table 5)
 - B' – coefficient, dependent on discharge height (table 7)
 - G – productivity of the discharge centre, t/h

For the localization of the dust sources it is necessary to use aspirating cover of the places of the charging in the conveyors.

Regulation of moisture of stone material, coming to drying is very important. It lets decrease level of emissions up to 5-7 %.

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Use of storage hoppers for short term storage of asphalt-concrete mixes lets decrease level of emission up to 10%.

Systems of dust collection should be used for gas treating and dust separation at Asphalt – Concrete Plants. They are aimed for protection of the environment. The dust collection systems must meet the following requirements:

- Purification efficiency must be not less than 99%;
- To take gas with high initial dustiness (40-300g/m³);
- To have high production, as 500-1000m³ of gas is formed during preparation of 1 ton of asphalt concrete mix;
- To have high temperature resistance (T- 4730);
- To provide stable work under condition of instable regime of technological equipment (Change of moisture, weather, machine lockup);
- To precipitate coarse and fine dust separately;
- To provide for utilization of dust;
- To work with low level of noise, to have an opportunity to construct antinoise barriers;
- To work in automatic and remote modes.

The following dust-collecting devices may be used: dust precipitation chambers, wet dry-separators, fabric filters, gravel filters, electric precipitators. In spite of an opportunity to use different efficient systems of air cleaning, the average efficiency of air clearing in asphalt concrete production is 70 %.

Work of machines in gas fuel significantly decreases quantity of gas and firm emissions. Survey of asphalt-concrete plants (ACP), working in gas fuel has shown low level of air pollution by all kinds of oxides and hydrocarbons.

Use of pollution-free technology for preparation of asphalt-concrete mixes is the solution of the problem of emissions. Ecological purity is provided when hot bitumen, coming to the mixer, melts and connects small particles in pre-combustion zone of the drum, so dust emissions significantly decreases.

Traffic regulation with road signs and road marking and rational distribution of traffic flows also protect the air.

Placement of road signs is important for traffic regulation. Signs are aimed for information of drivers about road conditions.

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The design provides for placement of the following signs:

- warning;
- priority;
- prohibitory;
- mandatory;
- informative;
- service.

In the system of measures for control of air pollution cooperation with medical services and road inspection (police) should take an important place.

Principles of distribution of emissions are close to the principles of noise distributions. So, for protection of centers of population, living along the road, it is necessary to provide for proper measures.

The following measures are recommended for reducing the noise level:

- traffic movement control (the traffic organization part is designed in the project), regulation of traffic follows increasing traffic figures;
- pavement must be of fine-grained asphalt-concrete mix, which reduces noise;
- the main kinds of work must be done during day time;
- non mobile plants (compressors) should be placed in special sound-absorbing tents and anechoic chambers, which decrease noise level up to 70%;
- during the period of rehabilitation, camps should be placed at the outskirts of centers of population with compulsory availability of sanitary zones around the camps.

Pollution by dust occurs during execution of many road works, especially with excavation and transportation of soil and construction materials. High emphasize should be placed on proper organization of work. Soil moisture must be optimal, which provides for good compaction and resistance to erosion. Good compacted soil forms nearly no dust during wind.

Excavation and haulage of soil during dry weather create up to 250 mg/m³ of dust, during work of transport on temporary soil roads, the concentration of dust runs up to 150-350 mg/m³, from each km of such road 350 - 700 m³ of dust is lost every year.

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Mineral dust from construction materials belongs to non toxic substances, but its concentration in the air is restricted by sanitary norms: 0,15 mg/m³ in the centers of population, 1 mg/m³ in the working zone for quartzit and sandstone and 6 mg/m³ for dolomite and chalky clay.

If wind velocity is up to 1 m/sec, particles with diameter 10 mk. are transported at a distance of up to 100 m, and with diameter 1 mk up to 900 m. Taking into consideration that average annual wind velocity in the road rehabilitation zone is 4.4 - 4,5 m/sec, the distance of dust transport increases for several times.

The design recommends the following measures:

- watering;
- construction of surfacing at temporary detour roads and construction sites;
- use of individual protection means;

Calculation of compensation for air pollution was not made because based on existing and forecasted traffic volumes it can be concluded that existing legal standards are met.

4.2 Measures for mitigating the adverse impacts on surface and subsoil water

During the construction works the Contractor is obliged to execute the following requirements in order to soften the impact on the surface and subsoil waters:

- The territories, regularly using water for dust reduction, including warehouses, concrete bituminous factories, must be equipped with drainage systems for water pouring in the special capacities for precipitation of solid particles. After precipitation, water can be repeatedly used for dedusting and cleaning.
- The contractor is forbidden to dump and merge any materials and substances received during works in water sources and low relief places.
- The contractor is obliged to keep clean and free of waste all constant and temporary waterways and spillways within and outside the building site.
- All polluted water and tail liquids from building sites must be collected to special capacities and buried so as not to pollute and poison water and ground.

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- Placing and work of the road building machines nearby the water sources is forbidden.

4.3 Measures for softening of adverse impact on the soil

With the purpose of natural surface preservation, liquidation and prevention of washout, mud-flow and ravines the project stipulates the following measures:

- Longitudinal slope of drainage ditch must be not more than 2% for prevention of washout (erosion).
- Cross slope of subgrade must be 1:4 (in exceptional cases in high embankments 1:1.5)
- strengthening of the inlets and outlets of all water-carrying constructions (culverts) and spillway by open concrete ditches of mattresses "Reno" for washout prevention.
- Construction of prefabricated reinforced concrete ditches along the sidewalks.
- Design decisions for decreasing of lead content in soil are described in before chapter on soils

The requirements to the Contractor for prevention of the soil pollution by combustive-lubricating materials are as follows:

- Storage of the combustive-lubricating materials , bitumen and chemical substances is provided only in the specially allocated and equipped places.
- All storehouses of fuel, bitumen and chemical substances must be on the waterproof base in the protected and fenced territory. The bottom, the walls and the top of the capacities and tanks for storage of these materials must be impenetrable and have the space for storage of 110% of the total required fuel or substance volume.
- Flood and discharge of the combustive-lubricating materials must be rigidly controlled according to the official rules.
- In the case of fuel and oils leakage the Contractor must take all necessary measures for liquidation of consequences and removal of the spilled substance to avoid influence on the environment (water, ground, air).

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- All storehouses, taps, fuel nose units must be protected from unauthorized access and vandalism. After using they must be disconnected and surely locked.
- The content of all capacities, bunkers and warehouses must be neatly marked.
- Discharge of any contaminants to water and soil is forbidden.

4.4 Measures for softening of adverse impact on subsoil

Use of minerals of the operating factories for needs of road-building works according to the recommendations of the road exploitation service and bodies of local authorities is provided by the contract.

It is necessary to conclude the Contract with the Competent body before the quarrying, i.e. mining of the ground.

After mining operations quarry is to be restored.

4.5 Measures for mitigating of adverse impact on the flora and fauna

Alongside the road habitats for fauna and flora occur.

Under the influence of constant gas pollution, noise and vibration the composition of flora and fauna may change.

Adverse impact on flora and fauna is mitigated by above described measures.

Victims of moving vehicles often become rodents, reptiles and insectivores, living in the right of way.

Metal light-reflecting barriers, provided by the design, frighten away the animals from the road.

Mushrooms have an ability to accumulate metals, including heavy metals from soil. So, it is forbidden to gather mushrooms near the road.

Under influence of anti-glaze salts soil structure is changing, tissues of plants destroy, as a result of poisoning by salts animals and birds may be impacted,

The best measure is to reduce use of salts during road operation and use frictional materials. Air pollution by dust occurs during execution of road works and has a negative influence on flora near the road.

Dust, depending on chemical composition, has a specific impact on plants, as harmful elements penetrate in tissues of leaves. Accumulation of chemical elements in tissues of plants causes destruction of metabolism and accelerates ageing process. Soil moisture has a significant influ-

ence on dust formation, so, it is important to use soil with enough moisture content, which forms nearly no dust during wind.

To some extent the adverse impact on flora and fauna are softened by all the above described, both designed, and recommended for the rehabilitation period measures. Hunting for wild animals and cutting down trees, without the permission of corresponding state bodies, within the public environmental protection service, are strictly prohibited.

4.6 Measures for mitigating of adverse impact on the social environment.

Influence of construction and rehabilitation is determined by traffic pollution, land acquisition for the road, demolition of buildings and destruction of infrastructure.

Measures for decreasing of negative consequences from the road rehabilitation such as decreasing of toxic emissions, noise level etc., provided by the project, are related to health and social life of population.

As a result of the road rehabilitation, with increasing cargo transportations, the role of the road in social - economic development of the region and life-support of population will significantly increase. Transportation of people and cargo will take less time. The road will give the opportunity for creation of additional enterprises and work vacancies.

Improvement of the road will decrease accidents.

After rehabilitation, the road will improve transport communication with Kyrgyz Republic.

4.7 Measures for mitigating the adverse impact on the land resources.

4.7.1 Allocation of land resources for road rehabilitation

The rehabilitated section of the road is part of the Republican road net. It will correspond to the 3-rd road technical category.

As a result of long period of exploitation without repairing works the road does not correspond to the technical requirements of SNIP KR 32 – 01: 2004.

The layout of the road, excavation of the quarries, temporary land allocation for crushed stone deposit and temporary building sites are approved by the land owners

The design provides for compensation of agricultural losses and other expenses, connected with the land allocation, in accordance with legislation of the Kyrgyz Republic.

4.7.2 Land reclamation

The major stage of the project realization is reclamation of the lands, destructed during the road-building works.

The project of the lands reclamation is developed according to the requirements of the normative documents in force in the Kyrgyz Republic:

- Instructions for drawing up of land reclamation projects in the Kyrgyz Republic.
- General requirements for land restoration GOST 17.5.3.04-83
- The Kyrgyz Republic government regulation " On approval of Standards for recovery of loses of agricultural and forestry grounds, caused by agricultural and forestry grounds withdrawal for use, not connected with agricultural and forestry needs and Rules of compensation of agricultural production losses, including the sums spent for grounds restoration".

Restoration of the temporarily occupied grounds for rehabilitation of the road section is executed by the project on the following sites:

- The Contractor's building site;
- Sites for different purposes ;
- Temporary access roads ;
- Sections, occupied (before flattening) by the old road.

Work package for the ground restoration consists of 2 stages:

The first stage – technical restoration which includes removal and storage of vegetative layer, leveling operation of the land, return of vegetative layer on the leveled surface.

The second stage – biological restoration which includes measures for restoration of fertility of the lands after the 1 stage, presowing treatment of soil, sowing of permanent grasses and after-sowing works.

4.8 Measures for mitigating the adverse impact of the road on traffic safety

Road rehabilitation requires restriction of traffic movement at the sections of construction works.

For traffic safety during operational period the project provides for the following conditions:

- construction of gentle slopes of subgrade (1:4)
- road striping by thermoplastic
- vertical road setting;
- placement of safety fences at the sections with high embankment;
- placement of signal posts;
- installation of road signs for traffic control and information for drivers;
- construction of bus-stops;
- construction of enclosed bus stops;

4.9 Measures for aesthetic design of the projected object

Roads, like any other technical construction directly affects the environment by changing of natural parameters. The wide range of tasks arises during road designing, which describes its connection with environment. The ecological safety of the road, aesthetical condition of the projected object and the degree of stability of the new natural-technical landscape depend on the solving of these problems. Preservation of the environment, necessity of the road and landscape combination and harmony with nature are the main principles of the landscape-aesthetical projecting.

In the international roads design rules of the European Community, aesthetic requirements are included in the evaluation of the road impact on drivers. At that, the elements of the landscape must be used for increasing of road traffic safety and comfort of its participants and for improving of visual orientation of drivers and passengers.

The measures, improving the road and landscape aesthetic are as follows:

- smoothness of the road surface in the plan alignment and longitudinal profile;
- road marking, controlling the traffic;
- facility of colored enclosures
- facility of flat slopes of the road bed smoothly transforming to the natural relief.

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- high level of self-descriptiveness of the road

The project **satisfies** all the above mentioned requirements.

4.10 Production waste

The technology of the road rehabilitation works and further road operation do not produce the waste, requiring placement and burial.

All construction materials have 100% use. Only construction garbage may appear during works, which should be taken out on a dump.

The contractor must give compensation to the organizations of nature protection for utilization of construction and sanitary waste.

Sanitary waste (during the rehabilitation period).

Number of people.	Standard	Reference to normative document	Design volume t/year
150	0.04 t/year	Sanitary purification manual	$120 \cdot 0.04 = \mathbf{6.0}$

4.11 Determination of water consumption for domestic and technical needs.

Calculation of domestic-drinking water supply is carried out in accordance with established procedure by the Kyrgyz Republic legislation, on the basis of the sanitary-and-epidemiologic supervision conclusion on the conformity of a source of water supply to sanitary rules and hygienic regulations.

Norms of water consumption for the period of the road rehabilitation are determined on the basis of normative term of construction, quantity of water consumption for one worker, according to SNIP 2.04.01-85*.

The calculated period of the road rehabilitation is 18 months (330 working days), the number of workers is 150 persons.

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Consumption of drinking water for the period of rehabilitation is:

Workdays (24 hours)	Number of people	Consumption of drinking water for 1 pers. litres	Total, Q1, m ³ , drinking water	Total m ³ \ 24 hours, drinking water	Number of conventional dishes	Consumption for 1 pers. In dining room, litres	Total, Q2, m ³ , in dining room	Total m ³ /24 hours in dining room	Shower cubicles	Consumption for 1 cubicle in day	Total, Q3, m ³ , for shower cubicles	Total
330	150	7	346.5	1.05	6.6	12	5227.2	15.84	10	500	1650.000	7223.7

Water for household use must be transported in special tank trucks.

List of water consumption for dedusting of the building site

Length of building site m.	Area of dedusting, m ² (drive in width 8 m)	Water consumption for dedusting l/h for 1m ²	Number of hours in shift	Number of shifts	Water requirement for 1 shift, m ³	Total water requirement, m ³
18079	126553	0.5	8	275	1431.00	601285

During the road rehabilitation **601285.00 m3 of water for technical needs and 7223.7 m3 for household needs** is required.

Water for technical needs should be taken from the Kirkol-Say river.

Technical water (water for technical needs) is used for watering of soil during compaction, for mixing of concrete and for dedusting of the temporary detour roads. After compaction of soil or material water evaporates in an atmosphere without pollution.

4.12 Safety measures and protection of labor during the road rehabilitation

The main part

Corresponding sectoral and departmental safety measures and industrial sanitary regulations should be observed during works.

Design decisions on road rehabilitation are accepted according to normative and constructive documents in force on transport construction which contain nature and environment preservation, labor protecting and the safety measures.

During works it is necessary to be guided by SNIP requirements 3.06.04-91 "The Safety measures during construction". For the road construction the "Safety regulations at construction, rehabilitation and the maintenance of roads", "Safety and industrial sanitation standards at construction of bridges and pipes" are in force. During road-building works it is necessary to use "Safety instructions" for each building machine. Shooting on contract terms must be carried out by the special organization, having allowing documents necessary for these purposes, drilling equipment, specialized motor transport, storehouses for bursting materials (BM) storage and qualified personnel. Directly on object of works it is necessary to provide industrial and life conditions of works: change houses for workers and shooting personnel, filling stations, area for storage of not established equipment, a platform for repair and preventive maintenance of the equipment. Explosive materials for single blasts will be delivered to the object of works by single delivery from the constant service storehouse of BM on the specially equipped transport. BM for current works (surfacing or the road, crushing of lumps, etc.) must be stored directly near to the object of works in short-term stationary storehouse of BM or in the mobile storehouse of BM equipped on the car. The BM storehouses adjoining to the object must be legalized in bodies of Gosgortekhnadzor and Ministry of Internal Affairs of KR. The object of rehabilitation is situated in mountain area, so, blasting operations should be carried out in accordance with requirements of the corresponding instructions approved by heads of the enterprises in coordination with bodies of Gosgortekhnadzor. Blasting operations must be made according to design and technical documentation: standard design for blasting works, projects for single blasts for each cut area.

The above described documentation for the blasting works must be developed by specialized organization "Vzrivprom"

Blasting works on the object must be carried out in strict conformity with requirements of "Uniform safety rules during blasting works", "Uniform safety rules during development of mineral deposits by open way" (publ.1994), Requirements of SNIPs in force.

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This project of the road rehabilitation stipulates the safety measures. The Contractor is responsible for carrying out of these measures. The contractor is obliged:

- to appoint SM(safety measures) Engineer who submits to the Project head;
- to provide obligatory preliminary and repeated instructing (introductory and general) at a workplace;
- to provide safety of a workplace and safe access to a workplace;
- to provide measures for liquidation of emergency situations, including procedure of evacuation from a building site;
- to provide fire safety by providing all building sites with fire-prevention equipment and signaling;
- to provide personal protective equipment (PPE) which must be used for protection of people against potential threat for a head, eyes, hands, legs, body, namely:
 - Footwear;
 - Glass,
 - Respirators;
 - Helmets;
 - Dielectric and protective gloves;
 - Soap;
 - Milk;
 - Medicine chests;
 - Industrial gymnastic and vitamin prophylaxis should be carried out for improving of immunity and capacity for work.

Individual means of protection must correspond to Government Standard (GOST) (an apron in accordance with GOST 12.4.029, rubber gloves in accordance with GOST 20010, a respirator of type "Lepestok" (GOST 12.4.028), gauntlets (GOST 12.4.010), glasses (GOST 12.4.013), gas masks of B mark or B with filter, helmets).

The contractor should be responsible for service and supplying of building sites without restriction, with electric energy, water, compressed air, communication facility, a temporary drainage system and the water drain.

The site should be in a safe, clean and good sanitary condition. The Contractor is responsible for the site clearing from trash, building and sanitary waste and its further taking out to place for HSW. At that he must be guided by SanPin (Sanitary regulations).

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Moreover, it is necessary to take regular checkup of machines and equipment for keeping their working order and observance of repair terms, training and instructing of workers servicing the machines, mechanisms and the equipment about safe methods of work. Protective measures in relation to the equipment are also important for prevention of traumas and accidents. To such equipment concern:

- Vehicles
- Pumps, compressors
- Generators, crushing equipment
- Lifting gear (cranes, elevators, cables, conveyors)
- The electric equipment.

Building sites and camps must be provided by first-aid sets with medicines, means of rendering of the first medical aid, drinking water and water for technical needs which should be stored in separate capacities. Drinking water should be not further than 75 m from a place of works. The sanction to water use must be received in bodies of Sanitary Inspection and correspond to the SanPin requirements.

The placing of camps is necessary to coordinate with Land surveying services and bodies of Government Sanitary Inspection "Gossanepidnadzor". The Contractor is obliged to provide medical service. The most important of medical services are the following: rendering of urgent help to victim on building site, adequate and fast transportation of the victim to the nearest hospital and support of the victim during transportation.

Primary obligations of the Contractor are subdivided into medical services, services in case of emergencies, transportation in the case of accidents up to the nearest hospital and financial support.

During works and elimination of defects it is necessary:

- To worry about safety of all employees working on a building site and keep the site in order, to avoid accidents;
- To provide light, safety barriers, banisters and warning signs;
- To take all necessary measures for environment protection on a building site and outside of it to avoid injury and other bad consequences for people and their property which may occur due to air pollution, noise or other reasons (for increas-

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ing of immunity, working capacity and labor activity it is necessary to use special complexes of industrial gymnastics and vitamin prophylaxis).

- All moving parts of machines and installations, electric and steam lines, and also places of materials coming and returning of finished product from machine must be safe protected. All installations which emit gas, steam or dust are to be equipped with reliable protective devices and ventilation.

All self-propelled and pull-type machines should be equipped by the sound and lamp signal system; During work at night, front and back light must be installed on the machines. In order to prevent accidents, steel cables and chains, as well as units of hydro systems of machines must be examined not less than one time a week. Free uncoupling from tractor for pull-type machines must be excluded.

Safety standards during road machines work.

Before the beginning of work serviceability of the engine, transmission, working bodies, coupling devices, levers and controls bodies, measuring devices, light and signal system, also presence of the inventory equipment, tools and spare parts should be carefully examined. At detection of any malfunction the machine must be stopped.

Work on failed machine is forbidden. During a stop, repair or transportation of road machines the measures excluding their spontaneous moving and overturning should be taken.

Works during dark time must be carried out in the presence of artificial light according to the norms of electric light for building and installation works. Irrespective of working places and sites lighting, the machine should have their own lighting of working elements and control mechanisms.

Road machines and engines of installations must be filled with fuel and lubricants on a horizontal area at natural or electric light from a electric supply network or accumulators.

During machines fueling it is forbidden to smoke, to light matches, to use kerosene lanterns or other sources of fire.

Fueling with ethyl gasoline is authorized only through filling stations. All other ways of fuelling in this case are strictly prohibited. Work of two or several self-propelled or pull typed machines, going one after another, including bench or wedge order, is allowed on condition that the least distances between them:

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- Scrapers, graders during road bed compaction 2 m
- Rollers during paving compaction 5 m
- Asphalt paver and roller 5m
- Concrete-laying and road finishing machines 10 m
- Other machines 20 m

Self-propelled and pull-typed road machines must not come to border of embankment or to edge of earthwork nearer than:

- Tractor with ramming board 0,5 m
- Excavator with ramming board 3,0 m
- Graders and motor graders 1,0 m
- Scrapers up to edge of embankment 1,0 m
- Up to the upper cut slope 0,5 m
- Distributors of crushed stone, gravel and sand 1,0 m

Storage of all kinds of fuel and chemical substances must be in the certain place with an obligatory protection made from barbed wire. The place of storage should be located far from sources of water and low places.

The area and enclosed territory must be convenient and must provide placing of tanks with 110% capacity from necessary quantity for fuel. Filling and unloading should be supervised and carried out strictly according to the established order. All latches and taps should be protected from undesirable actions and vandalism and must be closed and opened easily when are used. Interiors of tanks should be clean. Measurement should be carried out without consideration of the moisture and water influence.

The main safety measures during CBF(concrete bituminous factory) exploitation

Before starting of the factory equipment, all moving units and engines must be checked, all workers must be at the workplaces, signal must be given before the equipment starting. For ignition of atomizers at absence of auto ignition it is necessary to have a special torch; at start-

ing-up and regulation of atomizers the protecting screen from incombustible material should be installed.

At absence of automatic control system in CBF and CCF (cement concrete factory), workers of stone materials, mineral powder and cement warehouses, as well as weighers and automizer workers must be supplied by goggles. All bitumen taps should be opened gradually. The places polluted by bitumen, are necessary to clean and sand. Survey and repair of drying drums and mixers are allowed only after their full stop. Survey and repair of drums are allowed only after their cooling. At the CFB and CCF dedusting of all joints of installations and nodes of materials loading must be provided. Dust and gases aspiration by exhaust ventilation and dust catcher must be also provided. It is necessary to check presence and safety of all established enclosures on machines and installations of the CBF and CCF.

Bituminous storage at the CBF must have enclosure and must be covered by awning. Hatches of bituminous smelter and tank- boilers must be fixedly closed or equipped by fenders or protective covers.

At a sudden stop of one machine of a technological complex it is necessary to switch off immediately other units and mechanisms, at first in the direction from the point of machine loading, and then to the point of unloading of a ready mix. The beginning of work after such stop is allowed only by authority of shift mechanic.

On automated CBF and CCF it is necessary to check a condition and serviceability of all automatics system (the monitoring facilities and control devices) and mechanisms of local machines and devices starting.

4.13 Anticorrosive protection

The project stipulates the following protective measures of metal and ferro concrete structures from hostile environment: surface waterproof on pipes and other ferro-concrete constructions buried in the ground, use of traffic signs and indexes of factory manufacturing with anticorrosive protection.

5. Conclusions

The evaluation of impact on the environment as a result of project decisions is carried out at all stages of the construction life cycle from investments and allocation of the grounds to the road

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operation. Evaluation of the impact on the environment (EIE) is based on forecasts of ecological consequences that include changes of the environment as a result of construction and exploitation of the road. At that "the environment" includes all the factors influencing life conditions and health of a person: clarity of air, water, ground, flora and fauna, and social and economic conditions.

Rehabilitation of the road "Osh-Isfana" km 10 - km 28 ("Nookat Pass") will improve social and economic conditions of the population of region.

All constructive elements of the road will be executed in view of prevention of erosive processes.

As a result of the project realization, traffic safety on the road will be improved due to traffic control by the road furniture.

As a result of noise level calculations, excess of sanitary norms is not observed.

The verge of maximum concentration limit of harmful substances from transport emissions is located within the limits of the right of way.

Construction works of the road rehabilitation will not have essential adverse impact on flora and fauna. The broken soil surface will be restored during execution of technical stage of restoration.

As a result of the developed measures, the aesthetics of the road will be considerably improved. Therefore, all the actions, stipulated by the project for decreasing of adverse impact on the environment, will improve ecological conditions of the road site area.

The contractor is obliged to guarantee execution of all works, concerning the environmental protection requirements, according to the norms and regulations of the Kyrgyz Republic legislation.

As a result of the work of evaluation of the impact on the environment the "Statement on ecological consequences" is prepared. See the Basic Appendix 1 which contains:

- The basic results of the researches during EIE and the conclusion;
- Significant impacts on the environment and consequences for health and life activity of the population;
- obligations and guarantees of the project initiator for ensuring of ecological safety during the all period of the road exploitation;
- The Statement on ecological consequences is to be delivered by the Customer to all interested parties, authorities, management and control organizations.

6. Environmental Management Plan

The EMP describes the various measures proposed under this Project, which were designed to avoid or at least to mitigate the adverse environmental impacts that may result from the Project. As such the EMP considers all phases of the Project cycle, namely the detailed design, construction and operational phases of the Project.

To ensure that the proposed mitigation measures will be carried out by the contractors during the construction stage, the design consultant will clearly set out in the tender and contract documents the contractor's obligation to undertake the respective environmental mitigation measures.

The EMP is structured such that it lists all potential impacts identified in the frame of this EIA, provides a description of the respective proposed protection or mitigation measures and attributes the responsibilities for their implementation.

Tab. 1 Environmental Management Plan

MITIGATION MEASURES DURING DESIGN, CONSTRUCTION AND OPERATION				
Activity	Potential Impact	Mitigation measures	Institutional Responsibility	
			Implement	Monitor
DETAILED DESIGN PHASE				
Road alignment in areas of tree plantations. The distance from the tree stands to the planned road edge shall normally be sufficient to ensure preservation of trees. However in some stretches it may technically not be feasible to prevent the loss of individual trees.	Tree losses that cannot be prevented.	<p>Any tree losses are compensated by new plantations.</p> <p>Plantations shall be conducted after technical works have been completed. Planting time shall be restricted to spring (March till April) and/or autumn (September till October).</p> <p>Locations for tree plantings are within the existing Right of Way (ROW) at the locations where tree losses occur.</p>	Design consultant	Construction supervision (CS)
Rehabilitation and/or replacement of existing culvert.	Potential damage to local drainage or irrigation system if new culverts should not be sufficiently dimensioned or in case that not all existing culverts should be rehabilitated in the course of the road rehabilitation.	In the course of the road rehabilitation all existing culverts will be either cleaned, repaired or replaced, depending on their respective conditions. All culverts are sufficiently dimensioned in order to prevent any damages or blockages to existing the connected drainage or irrigation system.	Design consultant	Construction supervision (CS)
CONSTRUCTION PHASE				

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MITIGATION MEASURES DURING DESIGN, CONSTRUCTION AND OPERATION				
Activity	Potential Impact	Mitigation measures	Institutional Responsibility	
			Implement	Monitor
Top soil preservation	Loss of top soil.	Removing of top soil occurring within clearing corridor. Topsoil shall be removed and stored for reuse. Long-term stockpiles of topsoil will immediately be protected to prevent erosion or loss of fertility. For erosion protection it will be sown with a fast growing vegetation, e. g. grass	Contractor	Construction supervision (CS)
Operation of borrow areas and quarries	<p>Potential disfigurement of landscape, vegetation losses and damage to access roads</p> <p>Increased dust emission</p> <p>Siltation and obstruction of surface waters</p>	<p>All proposed borrow areas are already in operation. Thus environmental impacts concerning potential disfigurement of landscape, vegetation losses and damage to access roads are kept to a minimum.</p> <p>Wet aggregates and/or provide cover on haul trucks to minimize dust emission and material spillage.</p> <p>Locate stockpiles away from surface waters.</p> <p>Prior to operation of borrow area, the contractor shall submit a plan through the Construction Supervisor (CS) to the MoE indicating the location of the proposed extraction site as well as rehabilitation measures and implementation schedule for the borrow areas and access roads. Rehabilitation measures may not be necessary for borrow areas still in operation after road works have finished.</p>	Contractor	Construction supervision (CS)
Operation of asphalt plant	Odor emission and safety risks	<p>Asphalt plants shall be 1000 m downwind from settlements.</p> <p>Provide spill and fire protection equipment and submit an emergency response plan (in case of spills, accidents, fires and the like) to the authority in responsibility prior to operation of the plant.</p> <p>Secure official approval for installation and operation of asphalt plants from the MENR.</p>	Contractor	Construction supervision (CS), Project Implementation Unit (PIU)
	Water pollution due to spilled bitumen	<p>Bitumen will not be allowed to enter either running or dry streambeds nor shall it be disposed of in ditches or small waste disposal sites prepared by the contractor.</p> <p>Bitumen storage and mixing areas must be protected against spills and all contaminated soil must be properly handled according to legal environmental requirements. Such storage areas must be contained so that any spills can be immediately contained and cleaned up.</p>	Contractor	Construction supervision (CS)
Site selection, site	Potential soil and water pollution	The contractor shall submit documents for approval (short statement and site plan in appro-	Contractor	Construction supervision

MITIGATION MEASURES DURING DESIGN, CONSTRUCTION AND OPERATION				
Activity	Potential Impact	Mitigation measures	Institutional Responsibility	
			Implement	Monitor
preparation and operation of contractor's yard	tion	priate scale) which indicate: <ul style="list-style-type: none"> • Site location, surface area required and layout of the work camp. The layout plan shall also contain details of the proposed measures to address adverse environmental impacts resulting from its installation. • Sewage management plan for provision of sanitary latrines and proper sewage collection and disposal system to prevent pollution of watercourses; • Waste management plan covering provision of garbage tons, regular collection and disposal in a hygienic manner, as well as proposed disposal sites for various types of wastes (e.g., domestic waste, used tires, etc.) consistent with appropriate regulations; • Description and layout of equipment maintenance areas and lubricant and fuel storage facilities including distance from water sources and irrigation facilities. Storage facilities for fuels and chemicals will be located away from watercourses. Such facilities will be bounded and provided with impermeable lining to contain spillage and prevent soil and water contamination Prior to the commencement of works the site installations shall be inspected for approval		vision (CS), Project Implementation Unit
	Competition for water resources	Prior to establishment of the work camps, conduct consultations with local authorities to identify sources of water that will not compete with the local population.	Contractor	Construction supervision (CS)
Site selection, site preparation and operation of contractor's yard (continuation)	Health and safety risks to workers and adjacent communities	For health and safety protection of workers and adjacent communities the following shall be provided: <ul style="list-style-type: none"> • adequate health care facilities (including first aid facilities) within construction sites; • training of all construction workers in basic sanitation and health care issues, general health and safety matters, and on the specific hazards of their work; • personal protection equipment for workers, such as safety boots, helmets, gloves, protective clothing, goggles, and ear protection in accordance with legal legislation; • clean drinking water to all workers; • adequate protection to the general public, including safety barriers and marking of hazardous areas; • safe access across the construction site to people whose settlements and access are temporarily severed by road construction; • adequate drainage throughout the camps so that stagnant water bodies and puddles do not form; 	Contractor	Construction supervision (CS)

MITIGATION MEASURES DURING DESIGN, CONSTRUCTION AND OPERATION				
Activity	Potential Impact	Mitigation measures	Institutional Responsibility	
			Implement	Monitor
		<ul style="list-style-type: none"> sanitary latrines and garbage bins in construction site, which will be periodically cleared by the contractors to prevent outbreak of diseases. Where feasible the contractor will arrange the temporary integration of waste collection from work sites into existing waste collection systems and disposal facilities of nearby communities; 		
Work site operation / Operation of equipment maintenance and fuel storage areas	Worker's health and soil / water pollution	<p>The contractor shall hire a qualified health and safety expert who will provide safety training to the staff according to the requirements of the individual work place. Prior to the commencement of works, the work site personnel shall be instructed about safety rules for the handling and storage of hazardous substances (fuel, oil, lubricants, bitumen, paint etc.) and also the cleaning of the equipment. In preparation of this the contractor shall establish a short list of materials to be used (by quality and quantity) and provide a rough concept explaining the training / briefing that shall be provided for the construction personnel.</p> <p>Locate storage facilities for fuels and chemicals away from watercourses. Such facilities will be bounded and provided with impermeable lining to contain spillage and prevent soil and water contamination.</p> <p>Store and dispose waste/used oil consistent with environmental legal requirements.</p> <p>Work site restoration: After completion of construction works the contractor shall execute all works necessary to restore the sites to their original state (removal and proper disposal of all materials, wastes, installations, surface modeling if necessary, spreading and leveling of stored top soil).</p>	Contractor	Construction supervision (CS)
Operation of construction camp	Road construction projects bear a high potential risk to affect local communities and the health and well-being of those that live in or near to the temporary work camps by supporting the spread of STD and HIV/AIDS. In addition, the transport sector itself actually helps the epidemic,	Providing information to workers, encouraging changes in individual's personal behavior and encouraging the use of preventive measures. The goal of the information is to reduce the risk of HIV / STD transmission among the beneficiaries (construction workers and camp support staff)	Contractor	Construction supervision (CS), Ministry of Health

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MITIGATION MEASURES DURING DESIGN, CONSTRUCTION AND OPERATION				
Activity	Potential Impact	Mitigation measures	Institutional Responsibility	
			Implement	Monitor
	as infrastructure and associated transport services give people and infections mobility.			
Earth works and various construction activities	Loss of topsoil	Topsoil shall be stripped and reused to cover areas where excess materials will be dumped and on road embankments. In addition a soil management plan shall be provided detailing measures to be undertaken to minimize effects of wind and water erosion on stockpiles, measures to minimize loss of fertility of top soil, timeframes, haul routes and disposal sites.	Contractor	Construction supervision (CS)
Earth works and various construction activities (continuation)	Siltation of surface waters and/or impact on soils due to improper disposal of excess materials	Mostly all excavated material will be reused. In addition the reclaimed asphalt pavement will be recycled for the construction of new pavement. Thus potential impacts due to the need for disposal of excess material will be kept to a minimum.	Contractor	Construction supervision (CS)
	Competition for water resources	Conduct consultation with local authorities to identify sources of water (for spraying and other construction requirements) that will not compete with the local population.	Contractor	Construction supervision (CS)
	Air pollution due to exhaust emission from the operation of construction machinery	The contractor will maintain construction equipment to good standard and avoid, as much as possible, idling of engines. Banning of the use of machinery or equipment that cause excessive pollution (e.g., visible smoke).	Contractor	Construction supervision (CS)
	Disturbance of adjacent settlements due to elevated noise levels	Restrict work between 0600 to 2100 hours within 500m of the settlements. In addition, a limit of 70 dBA will be set in the vicinity of the construction site and strictly followed.	Contractor	Construction supervision (CS)
	Soil compaction due to operation of heavy equipment	Confine operation of heavy equipment within the corridor that is absolutely necessary for the road construction to avoid soil compaction and damage to pasture land.	Contractor	Construction supervision (CS)
Earth works and various construction activities (continuation)	Traffic impairment	Submit a traffic management plan to local traffic authorities prior to mobilization. Provide information to the public about the scope and schedule of construction activities and expected disruptions and access restrictions	Contractor	Construction supervision (CS),

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MITIGATION MEASURES DURING DESIGN, CONSTRUCTION AND OPERATION				
Activity	Potential Impact	Mitigation measures	Institutional Responsibility	
			Implement	Monitor
		Allow for adequate traffic flow around construction areas. Provide adequate signalization, appropriate lighting, well - designed traffic safety signs, barriers and flag persons for traffic control.		
OPERATION PHASE				
Increased traffic flow	Elevated levels of gaseous and noise emissions due to increased traffic. In addition increased pedestrian vs. vehicle accidents due to traffic volume and higher speed as a result of improved road design	Integrate in the engineering design safety features such as speed control signs, proper road markings, streetlights, pedestrian crossing, livestock crossing and other visual means.	Design Consultants	Construction Supervision (CS)
Increased traffic volumes and higher vehicle speeds	Increased risk of accidents with possible spills of harmful substances	Spill-contingency plan A contingency plan or emergency response plan is a set of procedures to be followed to minimize the effects of an abnormal event on the Project roads, such as a spill of oil, fuel or other substances that may harm drinking water resources or have adverse effects on the natural balance of sensitive areas.	Project Implementation Unit of State Road Administration	Project Implementation Unit
Damaged drainage or uncontrolled erosion.	Harmful environmental impacts resulting from damaged drainage or uncontrolled erosion.	Routine monitoring of drainage and erosion control at least twice a year.	Project Implementation Unit of State Road Administration	Project Implementation Unit

- Prior to construction works, the following method statements/plans shall be submitted by the Contractor for approval:
- A plan indicating the location of the proposed extraction site as well as rehabilitation measures to be implemented for the borrow areas and access roads upon project completion
- Dust management plan which shall include schedule for spraying on access road and details of the equipment to be used
- Layout of the work camp and details of the proposed measures to address adverse environmental impacts resulting from its installation. The plan shall be consistent with the provisions of the construction norms BCH 8-89
- Sewage management plan for provision of sanitary latrines and proper sewage collection and disposal system to prevent pollution of watercourses
- Waste management plan covering provision of garbage bins, regular collection and disposal in a hygienic manner, as well as proposed disposal sites for various types of wastes (e.g., domestic waste, used tires, etc.) consistent with appropriate regulations

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- Description and layout of equipment maintenance areas and lubricant and fuel storage facilities including distance from water sources and irrigation facilities. Storage facilities for fuels and chemicals will be located away from surface waters. Such facilities will be bounded and provided with impermeable lining to contain spillage and prevent soil and water contamination
- Soil Management Plan detailing measures to be undertaken to minimize effects of wind and water erosion on stockpiles of topsoil and excess materials, measures to minimize loss of fertility of top soil, timeframes, haul routes and disposal sites for excess materials.
- Emergency response plan (in case of spills, accidents, fires and the like) prior to operation of the asphalt plant
- A plan (mechanism and organizational structure) detailing the means by which local people can raise grievances arising from the construction process and how these will be addressed (e.g., through dialogues, consultations, etc.).

Method statement or plan for the execution of bridge construction works including measures that will be undertaken to address adverse environmental impacts

Tab. 2 Environmental Monitoring Plan

Issue	What parameter is to be monitored?	Where is the parameter to be monitored	How Is the parameter to be monitored?	When is the parameter to be monitored? Frequency	Institutional responsibility
Top soil preservation	Stockpiling and means of protection	Job site	Inspections; observation	Upon preparation of the construction site, after stockpiling and after completion of works on shoulders	Construction Supervision (CS)
Equipment servicing and fuelling	Prevention of spilling of oil and fuel	Contractor's yard	Inspections; observations	Unannounced inspections during construction	Construction Supervision (CS)
Worker's safety and health	Official approval for worker's camp; Availability of appropriate personal protective equipment; Organization of traffic on the construction site Provision of safety training to the staff according to the requirements of the individual work place	Job site and worker's camp	Inspection; interviews; comparisons with the Contractor's method statement	Weekly site visits by the hired Health and safety expert. Unannounced inspections during construction and upon complaint.	Construction Supervision (CS)

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Issue	What parameter is to be monitored?	Where is the parameter to be monitored	How Is the parameter to be monitored?	When is the parameter to be monitored? Frequency	Institutional responsibility
Worker's education on AIDS and STD	Has relevant education been provided?	To be determined by assigned Construction Supervision	To be determined by assigned Construction Supervision	After beginning of works and at appropriate intervals throughout construction	Construction Supervision (CS)
Material supply Asphalt plant	Possession of official approval or valid operation license	Asphalt plant	Inspection	Before work begins	Construction Supervision (CS)
Borrow areas	Possession of official approval or valid operation license	Sand and gravel borrow pit and / or quarry	Inspection	Before work begins	Construction Supervision (CS)
Material transport Asphalt	Are the truck loads covered or wetted?;	Job site / haul routes	Supervision	Unannounced inspections during work	Construction Supervision (CS)
Stone	Compliance with the Contractor's method statement (restricted working hours; haul routes) dust suppression methods where required	Job site / haul routes	Supervision spot checks	Unannounced inspections during work	Construction Supervision (CS)
Sand and gravel	Compliance with the Contractor's method statement (restricted working hours; haul routes) dust suppression methods where required	Job site / haul routes	Supervision	Unannounced inspections during work	Construction Supervision (CS)
Surface water protection	Contractor's compliance with his approved method statement	Bridges and Culverts	Inspection	Unannounced inspections during bridge and culvert works	Construction Supervision (CS)
Air pollution from improper maintenance of equipment Asphalt plant and Machinery	Exhaust fumes, dust	At site	Visual inspection	Unannounced inspections during construction works	Construction Supervision (CS)

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Issue	What parameter is to be monitored?	Where is the parameter to be monitored	How Is the parameter to be monitored?	When is the parameter to be monitored? Frequency	Institutional responsibility
Planting of new road side trees	Regular monitoring and control of successful growth of new planted trees	At locations of new planted trees	Replanting of trees that have died	Monitoring to be conducted in autumn so as to allow for replacement of failures	Contractor 1 st Year / Project Implementation Unit of Ministry of Transport
Increased road kills of animals due to higher traffic loads and vehicle speeds	Road kills of animals	Along the new road	Keep records of accidents. In the case that accident hot spots with large mammals are identified, appropriate protective measures shall be elaborated (e.g. reflectors / local fencing, warning signs, speed reductions etc.)	Throughout the Year	Regional Departments of Ministry of Transport
Increased traffic volumes may increase possible spills of harmful substances	Accidents that cause spills of harmful substances	Along the new road	Counting of accidents	Throughout the Year	Regional Departments of Ministry of Transport
Damaged drainage or uncontrolled erosion	Leakages in drainage system and damages due to erosion	Culverts and drainage facilities	Documentation	Throughout the Year	Regional Departments of Ministry of Transport

**PROTECTION OF THE ENVIRONMENT.
INTERNATIONAL TECHNICAL SPECIFICATIONS.**

General conditions

The Contractor must undertake all necessary safety measures and guarantee, that all works and actions, within and outside the site, will be carried out according to the legal norms and regulations of environmental protection.

The contractor must undertake all safety measures to avoid any unpleasant noise or vibration arising during work. It must be undertaken everywhere where it is possible to suppress noise at the source of its occurrence easier, than in other places.

These conditions should not be fulfilled in full measure in the case of urgent work in the critical situation for life or property saving.

If any waste, debris or mud pumps from building sites are stored in any adjacent territory, **the Contractor** should immediately take out such waste to clear the site and restore the damaged area, to satisfaction of the Engineer.

At presentation of the Program based on Technical specifications, **the Contractor** should present the softening plan of construction impact on the environment and ecological monitoring plan. If the conditions of the environmental preservation program are not observed, the construction supervision engineer has the right to suspend works of the contractor. **The Contractor** assigns the supervision over the execution of the ecological program to the one of the leading experts who has to control the activity of all personnel and report to the **supervision engineer**.

Storage of fuel and chemical substances

Storage of all kinds of fuel and chemical substances must be in the certain place with an obligatory protection from barbed wire. The place of storage must be located far from sources of water and low places.

The area and enclosed territory must be convenient and provide placing of tanks with 110% capacity from necessary quantity for fuel. Filling and unloading should be supervised and carried out strictly according to the established order. All latches and taps should be protected from undesirable actions and vandalism and must be closed and opened easily during use. Interiors of tanks should be clean. Measurement should be carried out without consideration of the moisture and water influence.

Quality of water

The Contractor should prevent any intervention connected with an exhaustion or pollution of water resources (including underground filtered water) during the works execution.

Areas, where water is constantly or periodically used for dedusting (including stacks at concrete and asphalt concrete factories), will be watered from specially designed tanks, permitting to control fall and flowing. After adjustment water can be used many times for dedusting and an irrigation.

All water and other liquid waste arising on sites, should be collected and taken out, without noise or pollution, to the allocated place.

The contractor is responsible for bringing into any water of any substances or materials appearing during works, except those from the sanction of the Engineer and the authorities controlling this question.

The contractor should guarantee that all existing channels and drainages within and near the Site will be untouched and protected from any debris and materials, appearing during works.

The contractor should protect all channels of the rivers, waterways, ditches, channels, drainages and lakes from pollution, mud accumulation, flood and erosion which may arise as a result of works .

The contractor should submit the details of its time drainage system (including all superficial channels, sedimentation tanks for a deposit, washing pools and dewatering wells) to the Engineer for approval before the beginning of work on the object.

APPENDIXES

1. Statement on ecological consequences
2. Climatic characteristic according to meteorological stations (MS)
3. Ecological calculations