SUPPLEMENTARY INITIAL ENVIRONMENTAL EXAMINATION

Project Number: 45169
Loan Number: 3056 / Grant Number 0366-KGZ
November 2018

Central Asia Regional Corridor 3 (Bishkek-Osh Road) Improvement Project, Phase 4. Engineering and Construction Supervision (section km 8,5 – km 15,9)

The Supplementary Initial Environmental Examination Report was prepared by the EPTISA Servicios De Ingenieria S.L./Eptisa Muhendislik/RAM Engineering company for the Ministry of Transport and Road of the Kyrgyz Republic in 2018 in accordance with the Kyrgyz Republic Environmental Protection Legislation and ADB requirements.

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TABLES

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ABBREVIATIONS

ADB	-	Asian Development Bank
AP	-	Affected Person
AIDS	-	Acquired immune deficiency syndrome
CAREC	-	Central Asia Regional Economic Cooperation
CSC	-	Construction Supervision Consultant
HIV	-	Human Immune Deficiency Virus
IEE	-	Initial Environmental Examination
IPIG	-	Investment Projects Implementation Group
km	-	Kilometer
LAR	-	Land acquisition and resettlement
NGO	-	Non-Governmental Organization
PAP	-	Project-Affected Person
PCU	-	Passenger car unit
PPTA	-	Project Preparatory Technical Assistance
RAP	-	Resettlement Action Plan
RP	-	Resettlement Plan
RoW	-	Right-of-Way
SA	-	Social assessment
STD	-	Sexually transmitted disease
SSEMP	-	Site Specific Environmental Management Plan
TA	-	Technical Assistance
TOR	-	Terms of Reference
TOC	-	Transportation and operating costs
VAT	-	Value added Tax
USD	-	US Dollar

EXECUTIVE SUMMARY

1. The Government of the Kyrgyz Republic has requested the Asian Development Bank (ADB) to identify, formulate, and prepare an ensuing loan and/or grant for the CAREC Corridor 3 (Bishkek-Osh) Improvement Project. This Supplementary Initial Environmental Examination (SIEE) has been prepared for a detailed project for a section of the km 8.5 - 15.9 km road, which is part of the Bishkek-Osh road. This SIEE is a supplement to the IEE prepared under the Bishkek-Osh project and should be read in conjunction with the main IEE, as this section is adjacent to the main section of the Bishkek-Osh highway from the city of Bishkek to the junction point with the northern bypass road of the city of Bishkek. The study covers the road section from Bishkek to Kara Balta, km 8.5 – km 15.9.

2. According to the categorization of ADB Safeguard Policy Statement, the main project CAREC Corridor 3 (Bishkek-Osh) Improvement Project has been categorized as B and this Supplementary Initial Environmental Examination (SIEE) for section km 8.5 – km 15.9 is a supplement, which has been prepared taking into account of the main project and the new section of the road. The proposed project will improve connectivity and access to markets in Kyrgyz Republic (KR). The outcome of the project will be efficient movement of freight and passenger traffic along the Bishkek-Osh road. In accordance with the legislation of the Kyrgyz Republic, the State Environmental Expertise is mandatory.

3. The report includes general information about the Kyrgyz Republic, relevant legislation and the project area. The report includes a detailed description of the proposed project and describes the current condition of the environment in the project area. Different environmentally sensitive receptors were identified and the impacts of the project have been analyzed from the perspective of the receptors, suitable mitigation measures have been identified to reduce the anticipated impacts to the technically possible minimum and an Environmental Management Plan (EMP) has been prepared accordingly.

4. Impacts from the project are expected to be limited spatially as well as in magnitude. Despite the fact that the most of the impact is limited by the construction period of the Project, some impact also occurs during the operation period. This impact is form due to increased traffic intensity and speed of vehicles and refers to increased levels of gas and noise emissions, as well as potentially increased accidents involving pedestrians and vehicles. In addition, there is an increased risk of emergencies associated with possible spills of harmful substances. The following impacts have been identified (i) noise impacts, emissions of pollutants into the air, as well as vibration, which is particularly important within settlements close to the Project road and in places where sensitive receptors are located, such as schools, hospitals, mosques, etc.; (ii) impacts on water courses and rivers; (iii) aggregate mining at borrow sites; and (iv) impact on soil and vegetation, including tree plantings near the Project road, due to clearing works; (v) impacts from the rehabilitation of bridges and drainage structures; (vi) impacts from operation of asphalt plant and aggregate crushing plants; (vii) the impact from the Contractor's work camps. In addition, the impact was divided into the following groups: impact during the design period, impact during the construction period and impact during the operation period.

5. Mitigation measures have been developed and incorporated into the Environmental Management Plan (EMP). In addition, before starting work, the Contractor should submit to IPIG and the Construction Supervision Consultant - the Site Specific Environmental Management Plan (SSEMP), covering the following aspects: (i) dust control; (ii) camp plan;

(iii) sewage disposal; (iv) waste and oil recycling; (v) description and layout plan of maintenance equipment and storage facilities; (vi) soil management (storage and reuse of topsoil); (vii) Emergency Response Assistance Plan; (viii) bridges reconstruction design. The SSEMP should be finalized and agreed with Construction Supervision Consultant and approved by IPIG.

I. INTRODUCTION

A. Background

6. In 2014 the construction supervision consultant EPTISA Servicios De Ingenieria S.L./Eptisa Muhendislik/RAM Engineering revise and update the IEE for CAREC Corridor 3 (Bishkek-Osh Road) Improvement Project, Phase 4 (section km 15,9 - km 61). In 2018 this IEE for main project has been updated, which included the results of studies on the vibration and noise modeling. Due to the fact that the new considered road section from km 8.5 - km 15.9 adjoins the main part of the Bishkek-Osh project road (km 15.9 - km 61), it is necessary to prepare an SIEE, which had been prepared by a consultant, cleared by ADB and approved by the MTR KR. A State Environmental Expertise in the State Agency for Environmental Protection and Forestry under the Government of the Kyrgyz Republic is required.

7. Background information on Kyrgyz Republic, the Project and the environment within the Project's area is given below.

8. The Kyrgyz Republic is a landlocked, mountainous country with formidable geographic barriers that seriously constrain its ability to effectively participate in international trade. Its development efforts are further hampered by inadequate physical infrastructure, which is in need of investment and regular maintenance.

9. Bishkek, the capital of the Kyrgyz Republic, is the country's political and economic hub with a dense population of 1002,1 thousand people. The largest city after Bishkek is Osh with a population of 288,000 people, located in the Fergana valley in the south. Osh is the main agricultural region of the country. These two cities' gross domestic product accounts for nearly half of the nation's. Approximately 80% of the country's industry is located in these two cities.

10. The Bishkek-Osh road represents about one fourth of international road corridor network in the Kyrgyz Republic, and links the country to Kazakhstan in the north, Uzbekistan and Tajikistan in the south, and the People's Republic of China in the southeast. It crosses four of the seven regions of the country and serves about 2 million people. It is the only direct surface link between the southern and northern parts of the country making it crucial for maintaining the country's social, political, and economic integrity. The Bishkek-Osh road forms part of the Central Asia Regional Economic Cooperation (CAREC) Corridor 3, which runs from the west and south Siberian region of the Russian Federation through Kazakhstan, Kyrgyz Republic, Tajikistan, Afghanistan, and Uzbekistan to the Middle East and South Asia.

11. The development of the transport sector is very important for landlocked Kyrgyz Republic as it will help ensure a cost-effective access to regional and domestic markets. It will also help generate employment and provide services throughout the country.

12. The proposed project will improve national and regional communications by rehabilitating the 7.4 km stretch of road adjacent to the Bishkek-Osh road. Through this section of the road, there is an exit from the city of Bishkek to the city of Osh, as well as an exit to the northern bypass of Bishkek.

13. The Government of the Kyrgyz Republic has requested the Asian Development Bank (ADB) use funds saved from the main project CAREC Corridor (Bishkek-Osh) Improvement Project, Phase 4. This SIEE has been prepared as part of the detail design. The study covers the road section from km 8.5 - km 15.9..

14. The benefit of the proposed project will be improved connectivity and access to markets. The outcome of the project will be efficient movement of freight and passenger traffic along the Bishkek-Osh road. The project outputs will be:

    (i) 7.4 km of rehabilitated road;
    (ii) strengthened road asset management system;
    (iii) improved road safety.

15. Environmental impact as a result of the rehabilitation of the project site will be, but they will have a temporary impact during the construction works on the site. As most of the construction work is planned to be carried out along the existing right of way. The impacts will include among others:

    (i) noise impacts, emission of pollutants to the air and vibration, which is of high significance within the settlements alongside this road and where sensitive receptors are located, such as schools, hospitals mosques are located (sensitive receptor clarified in Table 12 Alignment sheet) .
    (ii) impacts on culverts (drainage pipes across the road);
    (iii) impacts from aggregate sourcing at borrow-pits;
    (iv) impacts on soil and vegetation, including tree plantations alongside the Project road due to site clearance activities;
    (v) impacts from rehabilitation of 1 bridge;
    (vi) Impacts from asphalt plant and aggregate crushing plants;
    (vii) impacts from contractor's work camps.

16. In addition, the impact was divided into the following groups: those likely to take place during the design period, construction period, and operation period. Detailed description is presented in section "Environmental Impacts and Mitigation Measures" and in the Environmental Management Plan (EMP).

17. The road section is located between 8.5 км. and 15.9 km of Bishkek – Osh road. The section starts at the end of the administrative border of Bishkek at 8.5 km. At the beginning, the road has a 6-lane configuration, then reduces to a 4-lane configuration. The existing pavement in this section is asphalt concrete and the paved width is between 15 and 20 m. Shoulder width ranges from 1.5 to 3.0 m. The road continues westward, passing through a number of settlements interspersed by agricultural fields. The paved width is 8 to 12 m and the shoulder width is 1.5 to 3.0 m. The villages located along the road merge into a relatively continuous strip along the roadway. The terrain for the entire site can be classified as flat with altitudes ranging from 750 m to 800m.

18. From km 8.5 - km 13 there are houses, social and cultural facilities (school, pharmacy, government institutions, etc.), commercial services (shops, oil change stations, etc.). Plots of land located along the road from km 15 - km 15.9 (Left Side 900 m., Right Side 100 m. plots of land) is used mainly for agricultural purposes. Cultivated crops are mainly presented by wheat, feed and technical crops, different kinds of vegetables like potatoes, peppers, carrots, watermelon and eggplant and fruit plantations like apples and apricots.. Cultivated crops are mainly presented by wheat, feed and technical crops, different kinds of

vegetables like potatoes, peppers, carrots, watermelon and eggplant and fruit plantations like apples and apricots.

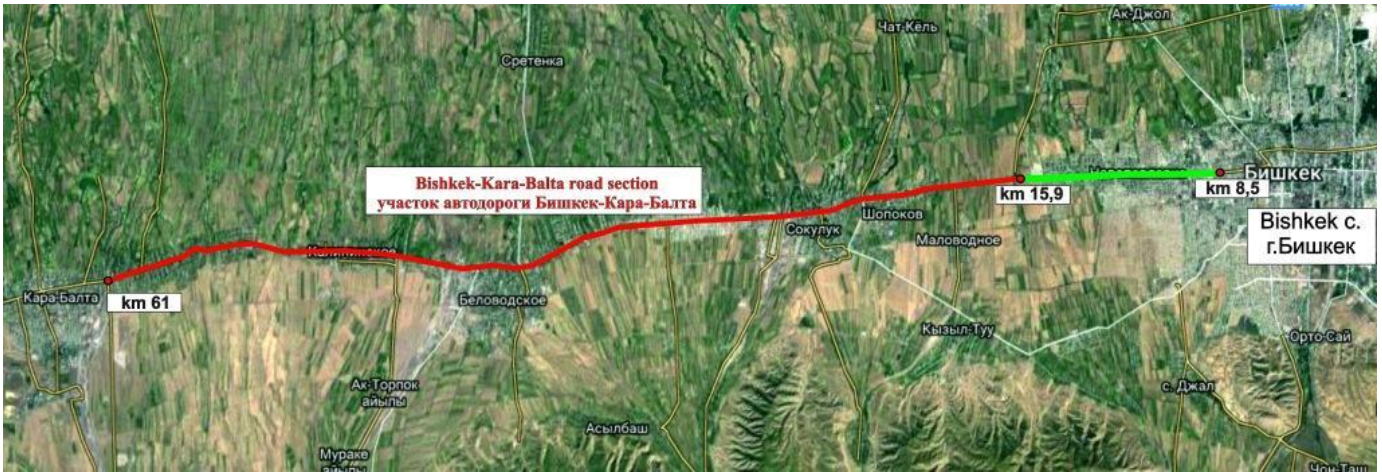

Figure 1 The section of the project road km 8,5 – km 15,9

19. Initially, when preparing the feasibility study for the project "CAREC Corridor (Bishkek-Osh) Improvement Project, Phase 4" the first field surveys for the environmental investigations were conducted in November 2012 for road section from km 8.5 - km 61. After determining the preliminary cost of the project, the section of the road km 8.5 - km 15.9 was excluded. In preparation for the feasibility study work was done on desktop study concerning the legal framework, project description and environmental baseline data. Available literature was studied and project data, statistical data, maps and aerial photographs compiled. Comprehensive site visits to collect data on the physical and biological environment were conducted in the spring, March and April 2013. In 2018, additional field studies were conducted to clarify the information received earlier. Based on field observations and surveys, environmental impacts were identified and appropriate mitigation measures prepared.

20. Due to the fact that the Project aims to rehabilitate the existing road, and taking into account the fact that there are no specially protected natural areas within the Project affected area, the resulting environmental impact is mainly limited by the construction period. In 2018, additional field studies were conducted to clarify the information received earlier. Based on this findings and further field inspections the SIEE was prepared in accordance the legislation of the Kyrgyz Republic and ADB SPS.

21. Sensitive receptors were identified alongside this section of road (Table 12. Alignment sheet) and baseline measurements were conducted in 2018. Public consultation meetings were organized with representatives of the public in 2013, with participation of residents of the surrounding. Minutes were taken and are attached to the report.

II. Policy, Legal and Administrative Framework

22. Environmental impact of the Bishkek – Osh Rehabilitation Project is regulated by a number of environmental legislative acts of the Kyrgyz Republic.

Table 1 Relevant Laws and Regulations on the Environmental Impacts of Road Projects

No	Legislation	Number Year of adoption	Purpose/content
Main laws on environmental protection			
1	The Constitution of the Kyrgz Republic	2010	Land, its mineral resources, airspace, waters, forests, flora and fauna and other natural resources are used, but at the same time are under protection. Everyone is obliged to take care of the environment, flora and fauna of the country.
2	The Environmental Safety Concept of KR	No.506 dtd. 23.11.2007	It establishes the basic principles of environmental policy and determines global, national and local environmental issues; priorities in the field of environmental protection at the national level as well as tools to ensure environmental safety
3	National Sustainable Development Strategy of the Kyrgyz Republic for 2013-2017	No.11 dtd. 21.01.2013	Provides a conceptual sustainable development framework aimed to satisfy the needs of current generations and not to endanger at the same time the needs of future generations.
4	Law of KR "On Environmental Protection"	No.53 dtd. 1999	Establishes the basic principles of environmental protection and provides legal authority to establish environmental quality, designate special protected areas, promulgate rules and procedures for the use of natural resources, establish environmental monitoring and control system and reinforce procedures for overcoming emergency situations. Among the standards and norms of environmental quality authorized under this law and related to the project there are: • Standards of Maximum Safe Concentration of Hazardous Substances in Air, Water; • Standards of Natural Resources Use; • Standards of Maximum Safe Noise, Vibration Levels and Other Hazardous Physical Impacts. This law establishes the requirements for environmental examination (environmental

			assessment) intended by economic or other activities to prevent potential adverse environmental impacts. In addition, it prohibits financing or implementation of projects related to the use of natural resources without obtaining approval from the State Environmental Expertise.
5	Law of KR "On Environmental Impact Assessment"	No.54 dtd. 1999	It is the main law, and related to environmental assessment. Its task is to prevent negative impacts on human health and environment occurring as a result of economic or other activities, and to ensure compliance of these activities with environmental requirements of the country.
6	Law of KR "General technical rules and regulations for environmental safety in the Kyrgyz Republic"	No.151 dtd. 2009	Is meant to protect the environment. It determines the main provisions for technical regulation of environmental safety and establishes general requirements for ensuring environmental safety during design and operations of businesses and other facilities of all legal and physical entities.
7	Regulation on procedure for conducting environmental impact assessment in the Kyrgyz Republic	No. 60 dtd. 13.02.2015	Establishes the procedure for assessing the environmental impact of the proposed activity (hereinafter EIA). The purpose of EIA is to prevent and/or mitigate the environmental impacts of the proposed activity and other related social, economic and other consequences.
8	Regulation on Water Zones and Strips of Water Bodies Protection in the Kyrgyz Republic	No.271 dtd. 7.07. 1995	Defines the procedure for establishing water zones and strips of water bodies protection in the Kyrgyz Republic, establishes a regime of economic activity and land use located in the water protection zones and strips. This law also defines responsibility for keeping them in proper shape.
9	Law of KR "On Protection of Atmospheric Air"	No.51 dtd. 1999	Governs the relations on use and protection of atmospheric air.
10	Law of KR "On Production and Consumption Waste"	No.89 dtd. 2001	Defines the national policy in production and consumption waste management. It is aimed at preventing negative impacts from production and consumption waste on the environment and human health while handling it and their maximum involvement in the economy as an additional source of raw materials.
11	Law of KR "On Protection and Use of Flora"	No.53 dtd. 2001	Establishes the legal framework for ensuring effective protection, rational use

			and reproduction of flora resources.
12	Law of KR "On Wildlife"	No.59 dtd. 1999	Establishes the legal relations in the context of protection, use and reproduction of wildlife.
13	Law of KR "On local self-government and local state administration"	No.101 dtd. 2011	Establishes the principles for setting-up local authorities at the level of administrative and territorial units of the Kyrgyz Republic.
14	Law of KR "On access to information under the jurisdiction of state and local self-government bodies of the Kyrgyz Republic»	No. 213 dtd 28.12.2006	The law regulates the rights and obligations of state bodies to provide information to the local population in order to achieve transparency of work.
Legislation on Land Acquisition			
15	The Constitution of the Kyrgyz Republic	2010	Clause 12 recognizes a diversity of forms of ownership and guarantees equal legal protection of private, state, municipal and other forms of property (Clause 12, paragraph 1). Land can be of private, municipal and other forms of ownership except for pastures, which cannot be privately owned (Clause 12, paragraph 5). Property is indefeasible. No one can be arbitrarily deprived of his property. Seizure of property by the state against the will of the owner is allowed only by court decision (Clause 12, paragraph 2). Seizure of property for public purposes specified in the law is possible by the court decision with fair and advanced compensation of property cost and other damages caused as a result of such alienation. (Clause 12, paragraph 2).
16	Civil Code	No.16 dtd. 8.05.1996 in the wording dtd. 30.05.2013	Determines that the person whose right is violated can demand full compensation for damages, unless the law or agreement consistent with the law says otherwise (Clause 14, paragraph 1). The Civil Code specifies the following losses subject to compensation: • expenses incurred or to be incurred by the person whose right is violated in connection with restoration of violated rights (Clause 14, paragraph 2); • loss or damage to property (Clause 14, paragraph 2); • lost income that would be received by the person under normal civil turnover

			conditions if his right was not violated (lost profits) (Clause 14, paragraph 2); • compensation for loss of profits along with the other costs, at least in the amount of such income, to the person loosing land, assets or livelihood.
17	Land Code	No.45 dtd. 2.06.1999 in the wording dtd. 26.05.2009	Governs land relations in the Kyrgyz Republic, basis for the origin, procedure for exercise and termination of rights to land and their registration, and also aimed to create land and market relations in state, communal and private ownership of land and efficient use and protection of land. The Land Code is the main document, which regulates land use.
18	Law of KR «On transfer (transformation) of land»	No. 145 dtd. 15.07.2013	This law is developed in accordance with the Land Code of the Kyrgyz Republic and other normative legal acts of the Kyrgyz Republic. It defines the legal basis, conditions and procedure for transfer (transformation) of land from one category to another or from one type of land to another.
19	Law «On Highways»	No.72 dtd. 2.06.1998	According to Clause 4 the public roads are owned by the state and not subject to sale and cannot be passed into private ownership. This law (Clause 27) also provides that without prior approval of the State Automobile Inspectorate and the Ministry of Transport and Communications of the Kyrgyz Republic the following is prohibited among others: • trade on the roadside; • placement of kiosks, pavilions and similar structures; and, • unauthorized use of road lands (Clause 23)
20	Regulation on valuation of assets		Valuation of assets is made based on the Provisional Rules of activities of valuators and valuation organizations (Government Resolution #537 dtd. August 21, 2003), property valuation standards (Government Resolution #217 dtd. April 3, 2006) and other national legislative provisions.
Law On Protection And Use Of Historical And Cultural Heritage			
21	The Law "On protection and use of historical and cultural heritage"	No.91 dtd. 26.07.1999	Establishes legal norms for protection and use of tangible historical and cultural heritage on the territory of the Kyrgyz Republic, which is of unique value for people. The law is mandatory for all legal

			entities and individuals. It defines their rights and obligations in the context of protection and use of tangible historical and cultural heritage. Historical and cultural heritage are the historical and cultural monuments associated with historical events in the life of the people, development of society and the state, material and spiritual creative works representing historical, scientific, artistic or other value.

International Conventions and Agreements

1	UN Framework Convention on Climate Change	2000	Combating global climate change and its consequences.
2	Aarhus Convention on access to information, public participation in decision-making and access to justice on environmental issues	2001	To support the protection of human rights to a healthy environment and well-being, access to information, public participation in decision-making and access to justice on issues related to the environment.

23. Ratification of international legal acts involves implementation of international requirements into the national legislation and harmonization of the Kyrgyz legislation with the international legislation. However, this process is moving very slowly in Kyrgyzstan given that conventions are really frameworks that need to be translated into national laws, a process that is time consuming and complicated.

ADB Safeguard Policies

24. As noted previously, ADB has classified the Bishkek – Osh road as category "B" for Environmental Assessment. The categorization was carried out based on ADB's Safeguard Policy Statement (2009), and ADB Methodological Guidelines on Environmental Assessment (2003). Because the Project is environmentally categorized as B, an IEE is required. An initial step in determining a project's environment category is to prepare a Rapid Environmental Assessment (REA) screening checklist, taking into account the type, size, and location of the proposed project. A project is classified as one of the following four environmental categories:[1]

- Category A: Projects with potential for significant adverse environmental impacts. An environmental impact assessment and a summary EIA (SEIA) are required to address significant impacts.
- Category B: Projects judged to have some adverse environmental impacts, but of lesser degree and/or significance than those for category A projects. In order to determine the probability of a significant negative impact on the environment, which will serve as the basis for the EIA, it is necessary to carry out a preliminary environmental assessment and

[1]ADB. 2003. *Environmental Assessment Guidelines*, Manila.

simplified IEE. If no EIA is needed, the IEE is considered to be the final environmental assessment report.

- Category C: Projects unlikely to have adverse environmental impacts. No EIA or IEE is required, although environmental implications are still reviewed.
- Category FI: Projects are classified as category FI if they involve a credit line through a financial intermediary or an equity investment in a financial intermediary. The financial intermediary must apply an environmental management system, unless all subprojects will result in insignificant impacts.

- *Environmental Management Plan:* Environmental Management Plan (EMP) is drawn up to address the potential impacts and risks identified by the environmental assessment. The level of detail and complexity of the EMP and the priority of certain measures and actions will be commensurate with the impact and risks of the project.

- *Public disclosure:* ADB will post the following protective measures documents on its website so that affected persons, other stakeholders, and general public can make a meaningful contribution to the design and implementation of the project:

25. At the stage of preparation of the feasibility study for the CAREC Corridor 3 (Bishkek-Osh) Improvement Project, which included this proposed section of the road, public consultation meetings on social and environmental issues were carried in June 2013 in Voenno Antonovka village. Minutes of the public consultation are attached to this report as Annex 1. The SIEE report should be submitted to the State Agency of Environmental Protection and Forestry of the Kyrgyz Republic for passing the State ecological expertise (SEE) and is a Supplementary of the overall project IEE, therefore should be read in conjunction with the main project IEE.

Environmental quality standards

26. During the realization of the Project, it is necessary to apply the following environmental quality standards.

1. Requirements for the air quality (additional standards are presented in the section on air quality)

Table 2 Air quality standards

Pollutants	**Maximum permissible concentrations (mg/m3)**	**Average daily concentration (mg / m3)**
Total suspended particulate:		
With content of silica > 70%	0.15	0.05
70-20% (cement, coal, clay, etc.)	0.3	0.1
< 20% (dolomite, etc.)	0.5	0.15
Cement dust (calcium oxide > 60%, silica>20%)	0.5	0.05
Sulphur dioxide, SO_2	0.5	0.05
Carbon monoxide, CO	5	3
Nitrogen dioxide, NO_2	0.085	0.04
Nitrogen oxide, NO	0.40	0.06
Lead (Pb) and compounds (except for	-	0.0003

tetraethyl)		
Lead sulphide (by lead)	-	0.0017

Source: Sanitary-hygienic standards SHS 2.1.6.1338-03 "Maximum permissible concentration (MPC) of pollutants in the ambient air of settlements.

2. Noise level requirements

Table 3 Noise Standards (Unit of measurement: dBA)

Description of activity/category	L_{eq}*		L_{max}**	
	Day	Night	Day	Night
Areas directly adjacent to hospitals and sanatorium	45	35	60	50
Areas immediately adjacent to dwellings, polyclinics, dispensaries, rest homes, holiday hotels, libraries, schools, etc	55	45	70	60
Areas immediately adjacent to hospitals and dormitories	60	50	75	65
Recreational areas in hospitals and sanitariums	35		50	
Residential areas, including , rest houses, sanitariums, schools, homes of aged, etc.	45		60	

SN (Sanitary Norms) 2.2.4/2.1.8.562-96 “Noise at workplaces, in dwelling rooms, in public buildings and at the area of residential development”.

3. Surface water quality requirements

27. The standards are presented in the Table below, based on the Water Legislation of the Kyrgyz Republic (Rules for the Protection of Surface Waters in the Kyrgyz Republic, No. 128 dated March 14, 2016).

Table 4 Surface Water quality standards [2]

	Norm
pH	6-9
Dissolved oxygen, DO, mg/l	<4
Sulphate, S, mg/l	<250
Ammonium nitrogen, NH4-N, mg/l	<3.3
Oil and grease, mg/l	<0.05

[2] More than 1,200 items are specified according to Kyrgyz Law.

III. DESCRIPTION OF THE PROJECT

A. Overview

28. CAREC 2020 will seek to improve industrial competitiveness through improvement of vehicle operating indicators of the road and development of economic corridors via more efficient movement of freight and passenger traffic along the Bishkek-Osh road. The project aims to rehabilitate 7.4 km road section from km 8.5 - km 15.9, which will improve travel from the city of Bishkek to the city of Kara-Balta, which is part of the Bishkek-Osh road..

29. Main tasks:

(i) provide safe and comfortable riding conditions to all road users, namely: to vehicles, cyclists and pedestrians, optimizing the road's intended function and the level of use;

(ii) provide the road at a minimum road life cycle ownership cost to the State Road Authorities (Government);

(iii) to comply with the Pavement Standards and other relevant State Road Authorities' Guidelines and/or Standards as they relate to Class I roads;

30. Conditions of the existing road are not up to KR Class IA-B standards (Table 5) as in many places road markings absent, traffic signs are insufficient and sometimes poorly located, and road surfaces and shoulders are usually poorly maintained. Guardrails on high embankments are only partly arranged and in bad condition. Bus stops along the road are generally damaged and have no roofs. Sidewalks have not been repaired since they were constructed and are not paved in some sections.

Table 5 Information about the road section km 8.5 – km 15.9

Road section	Carriageway width and length of sub-sections (km)	Bus stops km	Road signs	Length of inadequate Drainage (km)	Length of sidewalks to be reconstructed (km)	Intersection / Junctions
road section km 8.5 – km 15.9	6-lanes – 6.5 4-lanes – 0.9	22	60	6.5	6.5	40

B. Type and Category of Project

31. The main CAREC Corridor (Bishkek-Osh) Improvement Project, Phase 4 (section km 15.9 – km 61) aims to rehabilitate the CAREC transport corridor in terms of the Environmental Assessment, the project has been assigned the category "B". This SIEE has been prepared as part of the detail design and covers the new road section from km 8.5 - km 15.9, its an integral part of the main project IEE, which should be read together with. The proposed project will improve national and regional communications by rehabilitating the 7.4 km stretch of road adjacent to the Bishkek-Osh road. Through this section of the road, there is an exit from the city of Bishkek to the city of Osh, as well as an exit to the northern bypass of Bishkek.

C. Need for the Project

32. The Bishkek – Osh road is one of the most important transport corridors in Kyrgyzstan. Traffic, especially heavy vehicle volume, is high and increasing (which confirms that this section of the highway is the main national transport route). Considering the already described issues of the Project road, especially with regard to road safety, and also taking into account the fact that there are deep ruts and frequent irregularities on the road sections, which is a sign of insufficient road carrying capacity for the actual traffic load, the Rehabilitation Project is urgently needed The Government of the Kyrgyz Republic has requested the Asian Development Bank (ADB) use funds saved from the main project CAREC Corridor (Bishkek-Osh) Improvement Project, Phase 4.

D. Location

33. The Bishkek – Kara Balta road section is located between km 8.5 and 15.9 km of the Bishkek – Osh Road (Figure 2). The site starts at the end of the administrative border of Bishkek at 8.5 km. At the beginning the road has a 6-lane configuration, then reduces to a 4-lane configuration. The existing pavement n this section is asphalt concrete and the paved width is between 15 and 20 m. Shoulder width ranges from 1.5 to 3.0 m. The road continues westward, passing through a number of settlements interspersed by agricultural fields. The paved width is 8 to 12 m and the shoulder width is 1.5 to 3.0 m. The villages located along the road merge into a relatively continuous strip along the roadway. The terrain for the entire site can be classified as flat with altitudes ranging from 750 m to 800m.

Figure 1: Project road section at the M39 highway

E. Size or Magnitude of Operation

34. The project involves rehabilitation of 7.4 km road length of the Bishkek-Osh road. The Construction works will be carried out mainly within the existing road right-of-way, thus keeping environmental impacts to a minimum. The Project will involve a number of associated activities such as utilization of borrow areas, operation of asphalt plants and aggregate crushing plants, establishment of contractor's worker camps and storage sites, etc. But it is possible that the contractor will take measures to purchase all the material and services from local suppliers, including inert material, the rental of crushing plants, an asphalt plant, etc.

35. According to the Terms of Reference, the road pavement will be designed for an initial design life of 10 years with structural overlay options for 15 and 20 years of design life.

F. Traffic Volume

36. Taking into account the existing traffic intensity on the project road, identified by the analysis of traffic flows, and the expected national and regional economic development, forecasts have been developed for the growth of traffic intensity.

Table 6 Traffic count; vehicle totals for April 2015.

Location: km.8.5 – km 15.9	Date: 07 April, 2015, Tuesday	Time: from 00am to00am (24 hours)	Total
Direction: Bishkek to Kara-Balta		25775	57275
Direction: Kara-Balta to Bishkek		31500	
Location: Sadovoe, km.35	Date: 08 April, 2015, Wednesday	Time: from 07am to07am (24 hours)	Total
Direction: Bishkek to Kara-Balta		8868	17327
Direction: Kara-Balta to Bishkek		8459	
Location: Poltavka, km.53	Date: 09 April, 2015, Thursday	Time: from 07am to07am (24 hours)	Total
Direction: Bishkek to Kara-Balta		5435	10602
Direction: Kara-Balta to Bishkek		5167	

37. The expected growth rates of traffic flow are: 7% for passenger transport and 4% for freight transport up to the year of completion of the Project; in subsequent years, the annual growth will be 4% for both types of transport (passenger and freight).

38. According to the results of observations of the traffic flow made during the site visit, it can be assumed that this road section will classified as category I.

Table 7 Classification of roads in the Kyrgyz Republic

Road category	Volume to Capacity Ratio	Service level	The estimated traffic intensity		Economic and Administrative Value of Road
			Passenger car unit (PCU)	Vehicles	
IA	0.25 – 0.40	B: high	More than 18 000	More than 9 000	Motorway of international and national significance
IB	0.25 – 0.40	B: high	More than 14 000	More than 7 000	Main international roads and national significance (not covered by category IA)
II	0.40 – 0.60	C: medium	over 6 000 to 14 000	over 3 000 to 7 000	Highways of international and national importance (not covered by category IA and IB)
III	0.40 – 0.60	C: medium	over 2 000 to 6 000	over 1 000 to 3 000	Highways of international and national importance

					(not covered by category IA, IB and II)
IV	0.60 – 0.80	D: low	over 200 to 2 000	over 100 to 1 000	National and provincial local roads (not covered by category IB,II and III)
V	0.70 – 1.00	E: very low	under 200	under 100	Local roads with low traffic (not covered by category III and VI)

G. Proposed Schedule for Project Implementation

39. Construction schedule is at the preliminary planning stage. The draft of Bid documents will be prepared and approved in the beginning of 2019, and environmental clauses in line with the EMP will be integrated in the contract specifications. Bidding processes are likely to be held and completed before the start of the next construction season in 2019.

H. Project Details

The Project aims to rehabilitate 7.4 km of the Bishkek – Osh road, starting from Bishkek. Main project objectives are:

(i) provide safe and comfortable riding conditions to all road users, namely: motor vehicles, cyclists and pedestrians, optimized for the road's intended function and the level of use;
(ii) provide low cost of ownership (i.e. minimum whole of life cost) to the State Road Authorities (Government), and;
(iii) comply with the National Pavement Standards and other relevant State Road Authorities' Guidelines and/or Standards.

40. Using the field surveys and traffic observations in early 2015, and taking into account current road conditions, the preferred option was identified. This choice based on technical issues with a focus on where to apply (i) non-structural overlay, (ii) structural overlay, and (iii) reconstruction with/without lane widening. According to the existing project, it is planned to carry out construction work on the reconstruction of the existing road 6 lanes on the section 8.5 km - 15 km and 4 lanes on the section 15 km - 15.9 km..

41. The rehabilitation of the road will be carried out mainly within the existing right-of-way, thus minimizing the environmental impact. The project road section will be classified as category I:

- At the beginning, the road has a six-lane configuration of the carriageway, which then turns into a four-lane.
- Shoulder width on the road ranges from 1.5 to 3.0 m.
- The road embankment height in plain regions ranges from 0 to 2 m, in some places embankment is higher with a total height up to 4-6 m.
- The carriageway cross fall on straight sections has been taken as 2% and shoulder slope has been taken as 4%.

42. Rehabilitation activities include rehabilitation / reconstruction of road sections in accordance with the above parameters.

43. It should be noted that the scope of work of this project does not include the construction of additional lanes, although the road will be widened. Construction work will be carried out on

the reconstruction of the existing road. Therefore, the environmental impact is reduced to the technically possible minimum.

44. The inspection identified that practically in all settlements there are no culvert pipes, however in the road technical passport, submitted by the Employer, those are presence. The District Irrigation Management Departments are also assert about their presence, but inspection shows that there are no such pipes.

45. During the inspection road section km 8.5 -km 15.9, it was found that the culverts are in poor technical condition, and their maintenance is carried out untimely. Most of the more than 30 pipes must be replaced due to the need to change their size.

I. General Environment Profile

46. In terms of physical and biological environment, there are only a few ecologically significant zones along the project road section. These are strips of mature trees almost throughout the road, on both sides, as well as several small seasonal watercourses.

47. During the field inspections in this road section km 8.5 –km 15.9, 4 locally important sensitive receptors were identified. These are schools, market and mosque. These sensitive receptors are reviewed in detail in Alignment Sheet of this report. Starting from the Bishkek, these sensitive sites are:
    1. Novopavlovka village (School No.2)
    2. Novopavlovka village (market)
    3. Voenno-Antonovka village (school)
    4. Voenno-Antonovka village (mosque)

IV. DESCRIPTION OF THE ENVIRONMENT

A. Physical Recourses in Project Area

Topography

48. The topography of the Kyrgyz Republic is very diverse. It varies in elevation from 400 to 7000 m. It has several massive mountain ranges drawn mainly in a near east-west directions and several dividing intermountain valleys and depressions. The average elevation is 2750 m above sea level, the highest point is Pobeda Peak (7439 m) situated in the Central Tenir-Too at the edge of the Boz-Kyr ridge in the eastern extension of Kakshaal Too, at the border with China. The lowest point (401 m) is near Kulundy village in Leylek region of Batken oblast, in the vicinity of Tajik border.

49. A road section Bishkek-Kara-Balta is located within the relatively flat Chu Valley and traverses an area parallel to the Kyrgyz mountain range. Most of the section is at elevations ranging from approximately 750 to 800 meters above sea level.

50. To provide a solid base for the preliminary design and quantity estimate as well as to assess impacts of rehabilitation works on resettlement and land, a State Design Institute "Kyrgyzdortransproject" conducted a topographical survey (scale 1:2000), which included topographical details like existing roads, layout, drainage structures, buildings etc. Additionally, in 2018, detailed surveys were carried out on a scale of 1: 1000.

Soil and Geological Characteristics

51. The territory of Kyrgyz Republic is characterized by mountain terrain, which occupies the western part of the Tien Shan range and a small part of the North Pamir.

52. The project road section is located in the Chui valley. The relief is predominantly flat and not subject to landslides or rockslides. It is within the 9-point Seismic Risk Zone. The section is located within the area of distribution and accumulation of landslides with a very low risk of landfalls.

53. Soil erosion is a major environmental issue throughout the Kyrgyz Republic due to seismic activity, steep slopes, the fragility of the soils and human activities (such as inappropriate livestock management, the removal of protective vegetative cover and poor water management practices).

54. Soils of the road section are presented by northern grey common soils with low carbonate content. High salinity is one of its major characteristics. Soils in the section are highly productive and much of the area is in productive agricultural use. The erosion potential of the soils in this section is classified as low.

Climate

55. Kyrgyz Republic's is locating in the middle of Eurasia, its remoteness from oceans and seas and vicinity to deserts predefine formation of climate with the features of extreme continental climate, aridness and clearly defined seasons.

56. Great diversity of the country's terrain - deep roughness, various directions of mountain slopes against the sun and air flows – determines a clear vertical climatic zonation. 4 climatic zones can be observed in the Kyrgyz Republic.

57. Project areas are located in the valley-foothills belt. The valley-foothill belt (from 500—600 m to 900—1200 m) is exemplified by hot summer (up to 28°C), moderately cold and snowless winter with acute precipitation deficit. This belt has the features of subtropical climate.

58. In the project areas the average July temperature is 20-25°C, the average January temperature is -4—7°C. The maximum summer temperature is 44°C.

59. Precipitation in the project area is heavy with amounts up to 1000 mm at mid-mountain terrain of south-western slopes of the Fergana ridge. In Talas and Chuy valleys precipitation is lighter, from 250 to 500 mm.

60. Snowpack in the valley-foothills belt of south Kyrgyz Republic melts away several times in winter and reappears in case of new frosts. Snowpack is stable and rather thick at the heights of more than 1500 m. Snowpack becomes stable in late November and its thickness gets higher gradually and reaches its maximum by late January to early February. Stable snowpack melts away in March-April. Melting of stable snowpack in Chuy and Fergana valleys usually starts on the 3rd week of February.

Water resources

61. There are no regular water courses at the project road section. The road section is crossed by a discharge canal in Novo-Pavlovka village. Discharge canal in Novo-Pavlovka village canal was used as a flood bypass canal, emptying the runoff pond located upstream of the road and the village. Currently the canal is out of operation.

Figure 3 Discharge canal in Novopavlovka village

Table 8 Summary of Irrigation Structures

№	Station, Km	Watercourses	Maximum water discharge,(m^3/sec)	Structure	Length, width
1	11 + 200	Discharge canal	4	Culvert	6 x 12

Source: archive data of Kyrgyzhydromet, survey materials.

Air

62. Air pollution levels in the Kyrgyz Republic are serious issues within the urban areas. The primary sources of air pollution in Kyrgyz Republic's cities, including Bishkek and Kara Balta are thermal power stations, cement plants, chemical industries, urban transport and mining activities. There are many small industrial, municipal and transport enterprises within the municipal area that have both routine and sporadic atmospheric emissions, but no large industrial polluters such as oil refineries or metallurgical plants.

63. Air pollution monitoring is conducted by Kyrgyzhydromet, at 7 stations, intermittently, 3 times a day. In the Chui region, air quality control is carried out only in Kara-Balta city in 2 stations as shortened program, once a day on a rolling basis, for 20 minutes.

Noise

64. The existing ambient noise levels within the Bishkek – Kara-Balta road section are mainly related to traffic, as well as construction and borrow-pit works. Settlements are located near the road. Taking into account the width of the right of way of the Project area, significant noise impact on these residential areas can be easily avoided.

B. Ecological Resources in Project Area

65. The ecological conditions along the project road is mostly represented by anthropogenic landscapes and settlements. There are no specially protected natural areas (protected areas) in the immediate vicinity of the project area.

Fauna

66. Diversity of species in the Kyrgyz Republic is very high. According to official data, there are more than 500 species of vertebrates (including 83 mammals, 368 reptiles and 75 fishes), 2,000 species of fungi and over 3,000 insect species. Losses of habitat (deforestation), competition with livestock, hunting and poaching has caused the number of animals to shrink. The most critical situation involves protecting the habitats and populations of the most valuable (both economically and scientifically) species of big mammals such as mountain goats, djeyran, mountain sheep, snow leopard, tien-shan bear, lynx and Menzbir's marmot.

67. The project road passes mainly through settlements and some agricultural fields. In comparison with natural ecosystems, biodiversity is insignificant and represented by synanthropic animal species. Mammals along the sections include Norway rat, house and field mouse, and dwarf hamster. The following wild fauna representatives are rare: tolai hare, eared hedgehog, forest dormouse and fox.

68. Bird species in the sections are more diversified. Synanthropic species found along the road sections: tree and house sparrows, Afghan starling, blackbird, great tit, magpie, gray pigeon, turtle dove, sometimes there may be a white stork in the nesting area. Representatives of wild species: skylark, quail, oatmeal, heater, and representatives of crustaceans. On the fields there are birds of prey: goshawk, sparrowing hawk, common buzzard, red-headed buzzard, perch, black kite, serpent eagle, great spotted eagle, common kestrel, hoelock. The herpetofauna is represented by the following species: lake frog, green toad, Central Asian tortoise, gray gecko, Turkestan agama, desert lidless skink, water snake, sand stranger, arrow-snake, steppe viper.

69. The road section from Bishkek to Kara-Balta has been heavily disturbed by urban and agricultural development. The probability that a habitat of endangered or extinct species may occur here is very small.

Flora

70. Over 4,500 species of higher plants are reported to exist in Kyrgyz Republic. Steppe in the vicinity of the road section from Bishkek to Osh is covered with grasses and low shrubs such as saxaul and in some areas are covered by vast fields of wild poppies. Chiy, a common grass with whitish, cane-like reeds, is also common and used by the nomads to make decorative screens.

71. As the road section from Bishkek to Kara-Balta has been heavily disturbed by urban and agricultural development, the possibility that any habitat occurs, that is suitable for threatened or endangered plant species is low. Nearly all sidewalks along the project road section are planted with windbreak. Main of them are: elm (elm) (small-leaved and pyramidal), acacia and silver poplar. There are no any special protection zones in the vicinity of the road corridor.

Desertification

72. In December 1997, the Kyrgyz Republic joined the United Nations Convention to Combat Desertification, and ratified it in mid-1999. In the Convention, desertification is defined as degradation of lands in arid semi-arid, dry and semi-humid areas, which are the result of various factors, including climate change and human activities. By this definition, about 90% of agricultural lands in Kyrgyzstan can be included in the category, which can be defined as prone to desertification. Out of 10.6 million hectares of farmland most of which was used as pasture, about 74% is in some stage of desertification.

73. In the north part of the country, the average area of irrigated arable land available per capita is 0.35 – 0.2 ha and in the south it is 0.04 -0.05 ha, areas not sufficient for maintenance of the KR's food source. As a result, socio-economic condition of the country has been degrading. Though the areas of actual irrigated farming land are about 1 million hectares, nearly half of it is arid, salinized, chemically degraded and polluted. Nearly 4.5 million hectares or half of the territory occupied by pastures are degraded by erosion. Soil consolidation/compaction caused by livestock overgrazing has accelerated soil erosion on pastures located on steep slopes. Wind erosion is typical for non-irrigated pastures and meadow pastures located in the lower reaches. Black humus earth is compacted during wet conditions, resulting in loss of infiltration capacity and increased erodibility. Erosion is increased when cultivating meadow grass on fragile and steep slopes is cut and/or disturbed. Oftentimes such fields are plowed longitudinally, i.e. in line with the slope, which accelerates gully erosion, and land degradation. Overgrazing, which is s huge problem in the KR is causing a strong deterioration of pastures resulting in loss of agricultural productivity. Therefore, during the road reconstruction work all care must be taken to avoid creating conditions for new desertification.

74. Growth of population and focus on higher living standards induces year-to-year increasing pressure on land and water resources that form the basis of agricultural production. Most of Kyrgyz people live in rural areas and thus directly or indirectly depend on land productivity. Therefore, it is very important to ensure preservation and improvement of land productivity.

C. Human and Economic Resources

Population

75. The Kyrgyz Republic is a sparsely populated country. At the beginning of 2018, the resident population of the Kyrgyz Republic was 6 million 257 thousand people, present population - 6 million 2 thousand people. One third of the resident population (33.9 percent) lived in urban settlements and two thirds (66.1 percent) in rural ones. The population density was 31 people per square kilometer. The change in population is influenced by natural population growth, which is formed under the influence of changes in fertility and mortality rates, as well as the level of population migration. As the migration balance is still characterized by an excess of the number of emigrants over immigrants, population growth is achieved only through natural growth. For 2017 the population growth rate was 1.9 per cent, which is quite high by world standards. An important characteristic of the population of the Republic is the ratio of age groups younger than the able-bodied, able-bodied and older than the able-bodied age. At the beginning of 2018 it was 33.9 percent

76. The majority of the total population were children and adolescents, 58.6 per cent were people of working age and 7.5 per cent - people above working age.

77. As a result of emigration, as well as differences in the level of natural reproduction, there have been changes in the national composition of the population. Thus, proportion of Kyrgyz, Uzbeks and other nationalities increased, and proportion of Russians, Ukrainians, Belarusians, Jews, Germans and others decreased. But despite the high emigration in the 1990s and early 2000s, representatives of all nationalities historically living in the country are preserved. In total, more than 100 nationalities live in the country, the most numerous of them (as of the end of 2016) Kyrgyz-4 million 493 thousand people (73.2 per cent of the total population), Uzbeks-898 thousand (14.6 per cent) and Russians-357 thousand (5.8 per cent).

Table 9 Population along the project road

Oblast	**District**	**Distance from the beginning of the road (km)**	**Name of settlement**	**Population (thousand people., As of 31.12.2017)**
	Bishkek	8,5	Ala-Too mikrodistrict	
Chuiskiy	Sokulukskiy	8,5 – 10,9	**Novopavlovka** (≈50 households)	19.653
		10,9 – 14,4	Voenno-Antonovka	15,641

Source: National Statistical Committee of KR, 2017

Social Infrastructure

78. The Kyrgyz Republic is one of the poorest and most industrially underdeveloped country in the Europe and Central Asia (ECA) Region: Gross domestic product (GDP), calculated by the production method, according to preliminary estimates, in 2017 is amounted to 493.3 billion KGS and in compare with 2016 is increased by 4.5 percent. However, as in other former Soviet countries, the literacy rate remains high at >99% among people aged 15 and above (2009).

Table 10 Key social and economic indicators (Kyrgyz Republic)

		2016	2017
1	Resident population (million people)	5.81	6.25
2	Natural population growth (thousand people)	118.7	120.7
3	Total GDP (thousand som)	476331.2	493322.0
4	% in GDP:		
5	Agriculture	12.8	12.6
6	Industry and construction	26.5	27.0
7	Services	47.5	48.8
8	GDP per capita, thousand KGS	81777.8	83004.7
9	GDP in % to a previous year	101.6	102.7

Source: NSC. Statistical book «Information Note on Food Security and Poverty of the Kyrgyz Republic»

79. The poverty level in 2016, calculated by consumer spending, in the whole country was 25.4 percent and decreased by 6.7 percentage points compared to the previous year. The value of the total poverty line in 2016 amounted to 31151 KGS per year per capita, extreme - 17052 som. The poverty level in rural areas decreased by 4.6 percentage points, and in urban areas by 10.7 percentage points. 1 million 557 thousand people lived below the poverty line in 2016, 74.0 percent of which were residents of rural settlements.

80. Official statistics show that the level of poverty in the country is uneven.

Table 11 Poverty level in Chui oblast (%) in 2016

	Total	Urban Population	Rural population

Chui Oblast	30.3	16.0	33.4

Source: NSC. Statistical Book «Living standards of the Kyrgyz Republic population in 2009-2013».

Agriculture and Industry

81. Agriculture is the main sector of employment in the Kyrgyz Republic, and accounts for around one quarter of the GDP. As for January 1, 2018, more than 429,000 economic entities operating in agriculture sector, forestry and fishing have been registered in the Kyrgyz Republic. Among them, about 323 thousand, or 75.4 percent of the total number of such entities accounted for farms, 105 thousand subjects, or 24.6 percent - for individual entrepreneurs engaged in agricultural production. The volume of gross output of agriculture, forestry and fisheries sector, in 2017, for the Republic as a whole, amounted to 208,530.0 million KGS. Chui oblast accounts for 65.5 thousand, or 15.3 percent of economic entities.

Transport and Traffic accidents

82. Well-functioning transport sector is crucial to Kyrgyz Republic because of the mountainous terrain of the land locked country. It is important from many different aspects, including economic, social, and political.

83. The development of the transport sector is very important for landlocked Kyrgyz Republic, as it will help ensure a cost-effective access to regional and domestic markets. It will also help generate employment and provide services throughout the country.

84. This review process clarified that there are massive improvements required regarding the road safety situation and high casualty numbers in Kyrgyz Republic. However, there are a number of initiatives that have already been undertaken in the country, including the training of local road design and traffic engineers in Accident Black spot analysis and Road Safety Audit procedures, based on international best practice. The Traffic Police have also received training from international donors regarding enforcement procedures and use of specific equipment. A detailed Road Safety Strategy has already been produced and is currently being discussed by politicians at a high level.

85. This Strategy is the basis for the formulation and implementation of the state policy of the Kyrgyz Republic in the field of road safety at the national and local levels. The objective of the Strategy, defined by the authors, is to ensure, by 2023, an increase the safety level of all road users in the Kyrgyz Republic, reduce mortality and road traffic injuries as a result of road accidents by 30%.

86. To achieve the objective of the Strategy, the following priority areas are selected:
    I. Road safety Management.
    II. Improvement of road infrastructure.
    III. Improving of road users safety.
    IV. Improving the effectiveness of post-accident response.

87. There is no current national guidance on the provision of road safety education and many teachers use their own methods and resources to get the message across. It is necessary

to develop a practical guide for teachers on how to give information to children about road safety

88. Road traffic collision data for the project road sections was received from the Ministry of the Interior. Preliminary analysis has been carried out and has indicated the points on the route with the highest rate of accidents.

Cultural and Historical Sites

89. No historically or culturally significant sites have been identified along the road sections.

D. Alignment Sheets

90. The following alignment sheet provides an overview of environmentally sensitive hotspots and sensitive receptors alongside the Bishkek – Osh project road. The alignment sheets serve as a base for the following impact analysis.

Table 12 Alignment sheet

No	Location	KM	Issue/Picture	Baseline Data Parameters
Bishkek – Kara Balta section				
1	Novopavlovka village	9 - 10.9	Settlement alongside the road, sensitive hotspot with school buildings close to road administration building, shops, and church  Market Nurlan right on the road edge	Noise, vibration, SO2 NO2 CO Dust Baseline measurements taken with moveable instruments along the Project road

No	Location	KM	Issue/Picture	Baseline Data Parameters
2	Novopavlovka village		 Secondary school No.2	
3	Voenno-Antonovka village	13.1	Sensitive receptor.  Secondary School in Voenno-Antonovka v.	Dust, noise, vibration, SO2 NO2 CO
4	Voenno-Antonovka village	14.2	Sensitive receptor.  Mosque	Dust, noise, vibration, SO2 NO2 CO
5	g the project road	8.5 – 15.9	Nearly alongside the whole Project road tree plantations are stretching on both sides. Trees need to be newly planted for compensation.	Number of trees to be cut from 150 to

No	Location	KM	Issue/Picture	Baseline Data Parameters
				500 pcs

E. Baseline Measurements

91. In accordance with the above alignment sheet, background environmental indicators were measured in 2017 and 2018.

E.1. Air Quality Measurements

92. Measurement results will serve as reference values for monitoring during the construction phase. Air quality measurements were made at 4 points (Table 13) along the road, which were identified as areas sensitive to air pollution due to the proximity location of schools, street markets and other special facilities.

Table 13 Air Quality Sampling Stations.

No	Station No. and Location
1	203/1 – Novopavlovka village (school #2)
2	204/2 – Novopavlovka village (market)
3	205/3 – Voenno-Antonovka village (school, no number)
4	206/4 – Voenno-Antonovka village (mosque)

93. Measurements were carried out July 2018 according to legal requirements of RD 52.04.186-89 "Air Pollution Control Manual", GOST 50820-95 “Gas-cleaning and dust-collecting facilities. Methods for determining dust level of gas-dust flow”, Operations Manual for YAVSHA 413311.012, ИБЯЛ 416143004, ИБЯЛ 413411.042.[3]

94. To the measurement results of the air quality 2018 added data available for 2013, 2015, 2017 (Table 14). According to the data showed that KR standards for sulphur dioxide were exceeded in all sampling sites/points, carbon monoxide in two of the four points, excess of suspended solids, indicating serious air pollution along the road corridor..

[3] Analysis method:
1) Portable gas analyzer PGA-200. Operations Manual for YAVSHA 413311.012;
2) Air Pollution Control Manual RD 52.04 186-69;
3) Suspended particular matters concentration meter (ИКВЧ-В3). Operations manual for ИБЯЛ 416143004.

Table 14 Existing ambient air quality within 100 meter of impact corridor measured from 2013 to 2018 (mg/m^3)

	Location	**Distance**		**CO**				**NO2**			
No	**Name**	om edge of road (m)	**Chainage From Bishkek (km)**	**2013**	**2015**	**2017**	**2018**	**2013**	**2015**	**2017**	**2018**
1	Novopavlovka village (school No.2)	33	9.9	***6.5± 1.6***	1.2± 0.24	0,4± 0,08	1.5± 0.3	<0.01	0.070± 0.018	*0,023± 0.0058*	*0.238± 0.06*
2	Novopavlovka village (market)		11.0	3.8± 0.95	2.3± 0.46	2,9± 0,58	1.6± 0.32	<0.01	0.079± 0.020	*0,3± 0,075*	*0.244± 0.061*
3	Voenno-Antonovka village (school)	50	12.86	*4.9± 1.2*	1.2± 0.24	0,8± 0,16	0,7± 0,14	<0.01	0.018± 0.0045	*0,22± 0,055*	*0.145± 0.036*
4	Voenno-Antonovka village (mosque)	10	14.2	***6.2± 1.6***	1.6± 0.32	2,4± 0,48	0,8± 0,16	<0.01	0.041± 0.010	*0,22± 0,055*	*0.151± 0.038*
	Standart MPC			**5**				***0.85***			

Source: Consultant Measurement via Kyrgyz National Laboratory, 2015.
Note: numbers in italics indicate KR standard exceeded

	Location	Distance		SO2				TSP			
	Name	From edge of road (m)	Chainage From Bishkek (km)	2013	2015	2017	2018	2013	2015	2017	2018
1	Novopavlovka village (school No.2)	33	9.9	***3.2±0.8***	0.004± 0.001	0,004± 0,001	0.006± 0.00015	<0.1	**1.6±0.4**	0,4±0,1	**0,61±0,15**
2	Novopavlovka village (market)		11.0	***2.3±0.6***	0.007± 0.0018	0,009± 0.0023	0.005± 0.00013	<0.1	**2.2±0.6**	0,5±0,13	**1.6±0.32**
3	Voenno Antonovka village (school)	50	12.86	***1.2±0.3***	0.002± 0.0005	0,007± 0.0018	0.002± 0.0005	<0.1	**2.3±0.6**	0,5±0,13	**1.07±0.27**
4	Voenno Antonovka village (mosque)	10	14.2	***1.2±0.3***	0.002± 0.0005	0,006± 0,0015	0.003± 0.0008	<0.1	0.24±0.6	**0,7±0,18**	0.46±0,12
	Standard (MPC)			**0.5**				**0.5**			
	Source: Consultant Measurement via Kyrgyz National Laboratory, 2015. Note: numbers in italics indicate KR standard exceeded										

E.2 Water quality measurements

95. Taking into account that there are no surface watercourses at the project site, surface water quality measurements were not made.

E.3. Noise level measurements

96. The existing levels of external noise within the Bishkek – Osh road project area are mainly related to traffic, as well as construction works. The results of all measurements made, are exceed the permissible limits, both at night and during the day. Settlements along the road have noise coming from the road. Given the width of the right-of-way of the project site, significant noise impacts (if any) on these residential areas can be easily avoided.

Results of noise level measurements

97. The noise level measurement was undertaken using a noise level meter Oktava 101A No. 04A445, last calibrated in Dec. 2013. All measurements were taken in accordance with the Sanitary Norms 2.2.4/21.8.562-96 " Noise in the workplace, residential, public buildings and residential areas." The data (Table 19) clearly show that roadside commercial and residential facilities (sensitive receptors) are exposed to noise, the level of which is much higher than the permissible standards of the Kyrgyz Republic, this is particularly true for schools and hospitals.

98. In July 2018, Hagler Bailly prepared a Noise Modeling Report for 7.4 km section. (see Appendix 2). The following recommendations were made based on the results of the work:

Table 15 Existing noise levels determined along the road sections

No.	Noise measurement points	Km From Bishkek	Distance from carriage way to receptor (m)	Noise level, dBA. 2013 Field Measaremnt	2015 Average	2015 08.00 to 11.00	2015 17.00 to 19.00	2017 Average	2017 08.00 to 11.00	2017 17.00 to 19.00	Day time MPL Leq
1	Novopavlovka village, School No. 2	9.9	33	69	70.5	71	70	58.5	61	56	**55**
1a	Novopavlovka village, Market	11.0	10	62	67	66	68	71	72	70	**55**
2	Voenno-Antonovka village, school (50 m from the road)	12.86	50	70	61	61	61	64	67	61	**55**
3	Voenno-Antonovka village, mosque	14.2	10	61	74.2	73.4	75	71	72	70	**55**
Territories directly adjacent to residential buildings, polyclinic buildings, ambulatory buildings, dispensaries, rest homes, boarding houses, nursing homes for the elderly and disabled, kindergartens, schools and other educational institutions, libraries											

99. The results of measurements in 4 sampling points in 2015 and 2017 showed that the noise level at the project road section exceeds he maximum permissible level for each indicator. Such conditions will take place during the construction of the road. These high rates should in no case interference to the Contractor's works, aiming to minimize noise impacts during construction works. In fact, a possible mitigation plan for the most sensitive areas will be discussed and proposed.

100. Conclusion: The results of instrumental measurements show that the noise level in the residential area exceeds the maximum permissible level and does not meet the requirements of SanPiN 2.1.8.562-96 “Noise in the workplace, in residential areas, public buildings and residential areas.” Base: SN 2.2.4/2.1.8.562-96 " Noise in the workplace, residential, public buildings and residential areas.”

E.4. Vibration measurement

101. Vibration measurements in 2013 were carried out using the following device.

Measuring device	No	Calibration certificate		Valid until
		No	Date	
Octave 101B	04B361	BA06-05-8170	04.12.2012	04.12.2013

The results are presented in the table below.

Table 16 Vibration Measurement Results

№	Measurement place	Nature of Vibration						Octave-band vibration pressure level (dB) with mean-metric frequencies (hz)									Sound level (dBA)	
		By spectrum		By temporary														
		Wideband	Tonal	Constant	Fluctuating	Intermittent	Impulsive			1,0	2,0	4,0	8,0	16,0	31,5	63		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	20	
1	Novopavlovka (market)	+				+					70	79	72	73	77	80	80	Actual
2	Novopavlovka (school)	+				+					74	69	68	65	66	67	87	Actual
3	Voenno-Antonovka (mosque)	+				+					79	63	71	64	66	68	88	Actual
4	Voenno-Antonovka (school)	+				+					74	73	75	73	71	72	90	Actual

102. Conclusion: The results of instrumental measurements showed that the vibration level is not stabile; vibration is not controlled in the adjacent residential area by vibration speed.

103. Considering the complaints of residents of Petrovka village on vibration impact to houses during the construction of the Bishkek-Kara-Balta road in 2017, a Vibration Modeling was conducted at the Bishkek-Kara-Balta road section (km 15.9 - km 61). Based on the results of the Vibration modeling, it was decided not using vibration during construction works at the sections, where residential houses are located. The results of the Vibration modeling

are included in the IEE of the main Bishkek-Osh project. Considering that the considered section of the road, km 8.5 - km 15.9, passes through a densely populated area, work will be carried out without the use of vibration.

V ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

104. Based on legislation, the results of the field surveys and project description, environmental impacts were identified and suitable mitigation measures prepared. Because the Project involves the rehabilitation of an existing road and since there are no protected areas located within the Project zone, the environmental impacts are mostly related to the construction period. Mostly the impacts are related to the human environment, in particular, associated with noise levels, pollutant emissions, especially where the Project road is close to sensitive impact receptors, such as schools, hospitals, mosques, bazaars, etc. In general, the main impact categories arise from the following activities: (i) construction works within or close to settlements cause noise, emissions of pollutants into the atmosphere and vibration, which is particularly important in places where the Project road passes near the sensitive receptors (ii) site clearance activities entail degradation of top soil and vegetation structures (iii) aggregate sourcing, crushing of aggregates, as well as asphalt and concrete plant operation can have a serious impact in case of incorrect selection of sites and management. Additional impact relates to the following: (iv) the impact as a result of rehabilitation of bridges; (v) potential impacts on surface water. A detailed description of the impacts is provided in the following sections. The impacts were divided into the following types: impacts arising during the design phase, impacts arising during the construction phase, and impacts arising during the operation phase.

A. Design Phase

Physical Environment

105. A large number of the potentially significant impacts can be avoided by proper planning/preparation, including basic items such as ensuring that environmental clauses are included into the contract documents and that the SIEE and its EMP have been provided to the contractor and other relevant authorities, as well as providing proper information meeting and training on how the EMP is to be implemented. In this regard, mitigative measures have been defined in the EMP, the most important of which are correct distribution of assessment documents, inclusion of environmental rules/specifications in the bidding documents, environmental safeguards training of CSC and the Contractor, and the preparation of a tree cutting and management plan which will avoid unnecessary cutting of trees then replant and maintain new ones.

106. **Uncontrolled borrow-pit development.** Prevent such activities by requiring the contractor to comply with the mandatory procedures provided by the Kyrgyz Republic regulations, namely, the Contractor must obtain all necessary permits for the allocation of sites for borrow-pits or stockpiles from local authorities, coordinate with the territorial departments of the State Agency for environmental protection and forestry under the government of the Kyrgyz Republic, draw up a “Development Plan” and the “Borrow-pits reclamation Plan”, and submit the necessary documents to the MoTR to obtain a license for the development of borrow-pits at the State Agency for Geology and Mineral national resources of the Kyrgyz Republic.

107. **Uncontrolled temporary storage and recycling of asphalt waste.** A large volume of old asphalt concrete pavement will have to be crushed and removed for re-use as a material for sub-base or for filling of access and secondary roads. Prior to the start of

construction, upon the signing of the contract, the Contractor, in cooperation with the CSC and representatives of local government, should determine the streets to which the old asphalt will be transported for backfilling.

108. **Uncontrolled establishment of Asphalt and Concrete mobile batch plants.** Pavement material will be prepared in bunker facilities, installed along the road section. Here the materials will be mixed, loaded into trucks and transported to the construction sites for placement. These facilities are noisy, dusty, and emit a strong odour of bitumen. To minimize the impact on the population, these temporary facilities will be located close to the road, within the buffer zone, at a minimum distance of 500 meters from any settlement or public recreation area. It is not yet known, whether the crushing of aggregates will be carried out at the site, if so, the crushing plants should be equipped with dust-suppressive equipment (most modern crushers in the standard configuration have such equipment). The entire process of plant arrangement is controlled by SanPiN 2.2.1/2.1.1 Design, construction, reconstruction and operations of enterprises; planning and construction of residential sites/ and Sanitary-hygienic zones and sanitary classification of enterprises, structures and other facilities" and Sanitary-epidemiological rules and standards. SanPiN 2.2.1/2.1.1.006-03.

109. **Material Haul Route Plan**. About 200 thousand m^3 of construction materials will be handled mostly by trucks from borrow areas, aggregate plants and to and from temporary asphalt storage areas. The routes trucks use to haul these material, will impact local roadside communities. CSC will designate haul roads, preferably paved so as to minimize dust, and with a lowest density of residences as possible. The haul route plan will include road maintenance, safety and dust control. Any roads through residential areas will only be used between 07:00 and 18:00.

110. **Environmental Safeguard Implementation Training.** CSC will be required to have an environmental specialist on staff that will be fully familiar with implementation of IEE, EMP and monitoring compliance with environmental clauses contained in the contract specifications. This will also apply to the contractor and any field inspectors. CSC will develop and organize a 1/2- to 1-day briefing seminar(s) on EMP implementation and compliance monitoring, targeting the CSC's inspectors as well as the contractor. This session needs to be completed during the preconstruction period but after the contract has been awarded. It will be mandatory attendance for the contractor.

Ecological Environment

111. The main ecological impacts at the design phase of the project relate to minimizing the loss of trees along the road sections and implementing a rapid rehabilitation and landscaping plan. Plant communities are generally degraded and have been replaced by gardens, planted forest belts along the road, and cultivated or livestock grazing fields.

112. Impacts on the ecological environment are minimal since the project activities will be mainly located at the existing RoW, and special temporary storage sites will be defined. There are no constant surface watercourses at the project road section. Throughout the project road, within 500 meters, on both sides, there are no specially protected areas or places with biological variability.

113. **Tree Management Plan.** Throughout the project site, along 7.4 km (from km 8.5 Bishkek border to km15.9) the most obvious ecological zone is a strip of tree plantations,

which provides protection and shade. These tree plantations are represented by such species as Mature elm (elm), poplar and white acacia at the age of 40-60 years (Figure 4). Not only do they provide shade during the summer and act as a windbreak during the winter but trees sequester large volume of CO_2 per year.

114. Since the tree inventory has not been carried out, preliminary number of trees varies from 150 to 500. Therefore, when the contractor will design the road alignment, CSC will carry out tree inventory, as a first step in the pre-construction phase, and will indicate on schematic map of plantations all trees falling under the "inevitable" cutting. The CSC' environmental specialist, together with CSC design engineers will develop the tree management plan in order to minimize tree cutting. The definition of trees falling under the "inevitable" cutting, will be carried out taking into account the approach of maximum preservation of existing trees, by changing the angle of slope of the road or changing the design of the sidewalk.

115. The inevitable tree cutting will be compensated by new plantings at the rate of 1:3. In the process of preparing the project, it was determined that about 500 trees would need to be cut down. However, prior to the starting constraction work, the Consultant, together with the Contractor, will conduct a re-examination and take the necessary actions to save the maximum number of trees. Tree planting should be carried out after the completion of technical works at a separate road section (will not wait for the full completion of construction) in the spring (March to April) and/or autumn (October to November), when the trees have a great chance to settle down. Trees should be planted in those areas where tree cutting took place, taking into account the following parameters: height not less than 1.75 m, age - 5-7 years, distance between separate trees - 6–8 m, tree species - walnut, maple ash, elm, poplar white, willow white, white pseudo-acacia. Attention should be given to ensuring that "the right tree species are planted in the right places", for example, low trees should be planted under communication lines, thus reducing the need for large-scale pruning of tree branches in the future, etc.

116. In the pre-construction period, when CSC will complete tree inventory, it is necessary to order/reserve trees in local nurseries, as they are not always available. CSC will recommend the Contractor to hire a Subcontractor for implementation of the tree management plan, and to develop a program of planting and care of trees for the construction period and during the maintenance period. CSC will discuss with the IPIG/MoTR about the possibility of hiring local farmers and community organizations to plant and care for trees along the road, near their territory, with payment for the number of surviving trees each year.

117. Additional potential impacts to trees may include soil compaction near the tree stems, change of ground level near trees (over 30 cm), cover the soil around the trees with a waterproof material, the emission of toxic for trees material or physical damage to the root system. The negative impact on trees can be minimized by refraining from storing construction material and other heavy equipment that can compact the soil near the stems, using only organic material for potential backfilling near the trunks or fencing the area around the trees during construction works.

Figure 2. Elm, poplar and acacia along M39 motorway

Social Environment

118. Social environmental issues arising during this stage are related to providing people sustainable design solutions as well as considering the possibility of involving local residents living along the road. The following are the most important issues:

119. **Access Management Process During Road Construction** – Any project involving capital construction in the form of a complete reconstruction of the highway, rehabilitation of large culverts and all bridges will require bypass roads, road lane closures and restricted access for local residents, for example, intersections will be closed for a certain time. In order to minimize these inconveniences, the CSC jointly with the Contractor will prepare a road safety plan, which must be approved by the Traffic Police of Kyrgyz Republic, defining how to organize bypass roads, what precautions must be taken, and how to ensure the movement of vehicles, pedestrians and livestock. In accordance with this plan, the Contractor must take all necessary measures to ensure road safety during the construction period. The information should include the provision of personnel for traffic management, a plan of public meetings with local communities prior to the commencement of the work, and the subsequent restoration of the roads after the completion of the work, at least to their original state.

120. **Pedestrian crossings** present a special problem, as the road is densely occupied by locals, commercial and small production facilities. People will need to cross the road, what was initially very dangerous, due to the lack of traffic lights, and the movement of vehicles is unstable and usually high-speed. The width of the carriageway, in some places >35m, and it is difficult to cross. The solution will be either traffic lights that will require vehicles to stop, or arrangement of pedestrian overcrossing. Traffic lights seem problematic because of the well-known habits of unruly driving among Kyrgyz drivers and the tendency to drive through the yellow light and ignore traffic lights in the evening. Traffic lights along the highway M39 pose a particular threat to pedestrians and, of course, slow down traffic.

121. During the construction of pedestrian sidewalks, to eliminate inconvenience for pedestrians the consultant design team will prepare a pedestrian management plan, that

will determine where and what kind of crossing structure will be installed. In the places where the construction of new sidewalks will be carried out fences and special signs will be installed. Along the median lanes, the high parapets will be installed, making it impossible to cross the road.

122. **Public Toilets** – Rest stops or toilets will not be provided under the project since there are a few petrol stations along the project road section, which already have public toilets.

123. **Bus stops** – Bus traffic, especially by the mini-buses (marshrutkas), is intensive and under existing condition very dangerous, as there are no clearly marked and outfitted bus stops. Where it is, it is in a very poor condition and does not ensure the safety of passengers. All old bus stops will be replaced with new ones.

CONSTRUCTION PHASE

124. Potential construction period impacts, listed in the EMP tables, are mainly focused on the control of atmospheric emissions and noise levels through monitoring, proper management of earthworks, waste contractor good-housekeeping practices associated with fuel and lubricant management, the removal of waste from the work camp, and occupation health and safety practices for the contractor's workforce. The main points of the EMP are discussed in detail below.

Physical Environment

(a) Air Quality, Noise and Vibration

125. Air quality impacts during construction will originate from different sources. Sources include construction machinery exhausts, fugitive emissions from asphalt plants, aggregate crushing plants, and dust generated from construction works, haul roads, exposed soils, and material stock piles.

126. The noise level from construction works will be significant, since all the existing roadbed will be removed using jackhammers and similar equipment installed on excavators (noise level is about 89-90 dBA and 15 m from the working area), however it will be temporary and occur from a working construction equipment. Summarizing the results of the Noise Modeling research, it is expected that: (w) there will be a temporary impact from the noise of the operating equipment during the construction period, which will be temporary; (w) after completion of construction works and laying of new asphalt (Porous asphalt; pores >15% 0/11. The nose is applied the operational noise levels will drop), as well as reducing the speed limit from 60 km / h to 50 km / h, it will prevent the increase in noise from vehicles. Regarding the reduction of the allowable speed for vehicles, the Government of the Kyrgyz Republic is currently planning to make a change in the regulatory legal acts and to establish the allowable speed limit in populated areas of 50 km / h..

127. With regards vibration, based on the results of the Vibration Modeling study conducted under the Bishkek-Osh project, it was decided to carry out construction work without using vibration. The number of passages of the rollers will be increased to achieve the quality of compaction.

128. The impact on air quality from asphalt mixing plants, crushers and dust emissions has been discussed above.

129. The following mitigation measures will be implemented by the contractor to reduce emission levels of construction equipment: (i) maintenance of construction equipment to maintain its good condition and to avoid, as far as possible, engine idling; (ii) prohibition of the use of machinery or equipment that is a source of excessive pollution (for example, visible exhaust gases); (iii) the contractor should use construction equipment with a low level of emissions, and iv) any vehicle at the construction site should be shut down if it is not in use or remains unattended for more than 3 minutes.

130. Settlements are already subject to air pollution, noise and vibration from vehicles, and during construction all this will worsen even more (except for vibration). To reduce the level of noise exposure in particularly vulnerable areas, temporary noise barriers may be used to undertake measures to reduce the noise level.

131. The negative effects of noise can be reduced by limiting construction work from 07: 00 am to 18:30 PM in urban areas, and from 06:00 am to 19:00 PM in settlements located 500 m from the place of work, as well as by limiting the transportation of construction materials through settlements. Noise impact monitoring during construction is carried out in accordance with the provisions of the EMP. The Noise Modelling study undertaken for this section, which report is attached as part of Annex 2, in this SIEE provides full detailed measures to be followed during construction activities.

132. The air quality and noise impact monitoring program will be applied to sensitive receptors were identified alongside this section of road (Table 12. Alignment sheet), details of these sections are presented in Alignment Sheet in table 16. Monitoring will be carried out on a quarterly basis to assess air quality and noise exposure at each section, i.e. at the location of the receptor (vulnerable object). Analyzes will be carried out on the content of: CO, NO2, SO2, suspended solids and level of noise exposure.

(b) Surface and Ground water

133. **Surface water** – The project section of the road does not cross natural rivers, flood control canals and irrigation canals. The road at this road section is crossed only by the discharge canal in Novopavlovka village which was used as a flood bypass canal, emptying the runoff pond located upstream of the road and the village. Currently the canal is out of operation.

134. Since there is no crossing point between the watercourses and the road, there will be no potential impact on surface waters.

135. **Ground water** – The depth of groundwater on this stretch of road is more than 6 meters, and the risk of contamination during construction works is minimal. However, the depth of groundwater depends on the water content of the season. During the construction period, the consultant will monitor and In cases of risk of contamination apply corrective protective measures. There are no open water sources along this stretch of the road.

(c) Topsoil Protection and Erosion

136. The impacts on soil originate from the compaction of soil, site preparation and clearance, and loss due to rain and wind-related losses due to improper storage. Compaction can lead to degradation of the soil's usefulness, especially along the length of the alignment. To prevent soil compaction, the contractor shall limit the use of heavy machinery to the existing RoW especially in the vicinity of agricultural land. Agricultural land located from km 15 - km 15.9 (Left Side 900 m., Right Side 100 m.).

137. Site preparation and clearance includes stripping and temporary storage of topsoil. The associated impacts to site preparation and clearance activities are expected to be spatially limited to small strips alongside the already existing road. The removed topsoil will be stored for re-use and long-term stockpiles of topsoil will be protected against erosion. This will be done by, for example, seeding the stockpiles with fast growing shallow root grasses.

138. To ensure proper soil management the contractor will submit a soil management checklist at commencement of each construction year. This checklist will include a simple listing of measures for minimizing water and wind erosion losses. As long as topsoil stockpiles remain unused, the seeded grass cover will remain in place.

(d) Contamination from Earthworks, Aggregate, Concrete and Asphalt Plant

139. **Borrow pits** – When planning to open a new borrow site, the contractor, working with the framework instruction provided as part of the mitigative measures, will need to get both the extraction permit and approval of a development plan, and later on approval of borrow pit restoration plan. The Contractor shall obtain all required permits for use of borrow pits and disposal areas from local authorities, get approval from regional departments of the State Agency for environmental protection and forestry under Kyrgyz Republic Government, prepare a «Borrow Pits Development and Restoration Plan" and pass all necessary documents to MOTR of KR to obtain a license to extract aggregate materials from the State Agency for Geology and Mineral Resources. The use of existing borrow or aggregated facilities will not require such actions. In the case of the use of private borrow-pits all permits (licenses, approval from local authorities, Territorial Administration for Environmental Protection and Forestry farms, etc.) is the responsibility of the owner of the borrow-pit, who should be specified in the Contracts between the Contractor and the Owner of the borrow-pit. The contractor will need to prepare a site development plan, which should contain the following information:

- capacity and operation hours of a borrow pit;
- development and extraction sequence of borrow pit;
- technique and mechanisms for stripping and excavation operations;
- operation and time schedule for borrow pit development;
- extraction method and transport plan, including route(s);
- safety rules and hours of operation;
- expected quality of extracted materials;
- topsoil storage/protection and environment protection steps; and,
- rehabilitation of disturbed lands when site is decommissioned.
- Calculation of fees for emissions of pollutants into the atmosphere from mobile sources.

140. To minimize dust the contractor shall develop a dust suppression program and have it approved by the CSC. The Program will ensure that unpaved haul routes, which pass settlements, are whetted in order to suppress dust, and ensure that all trucks hauling

materials will use covers for the load to prevent dust pollution. Air quality monitoring will involve accurate registration of dust (particulate matter) emissions, in order to establish compliance with Kyrgyz regulations and specifications of the EMP.

141. **Asphalt, Concrete and Crushing Plant Pollution** – During the selection of the Asphalt and concrete plant, stone crusher equipment, which emit pollutants, noise and transmits vibrations, the contractor will be installed and will have to comply with SanPiN 2.2.1/2.1.1 and SanPiN 2.2.1/2.1.1.006-03, and establish a specific buffer zone around any such facility. In the KR this is referred to as a sanitary-hygienic zone, and is a mandatory element of any facility that affects habitats and human health. The sanitary-hygenic zone (SHZ) separates the area of an industrial site from residential areas, landscape and recreation areas, parks, and health resorts with mandatory demarcation of boundaries by using specialized information signs. The boundaries are as follows:

Class II – SHZ 500m.
Production of asphalt-concrete at fixed plants.
Production of asphalt-concrete at mobile plants.

Class III – SHZ 300m.
Production of crushed stone, gravel and sand, milling of quartz sand.

Class III – SHZ 300m.
Borrow pits of gravel, sand, and clay.
Bitumen plants

Class IV – SHZ 100m.
Concrete solution plants.

(e) Bridge/Culvert Rehabilitation

142. Bridges – This bridge is located on the channel for the passage of mudflows and high water during the period of heavy rains. For the most part, this channel is dry..

143. As the watercourse which will be partially reconstructed is a canal for mud flow, the impact from the reconstruction of the bridges will be minimal, suggesting that it will apply good practice of construction, and will be followed mitigation measures related to good practices of management by the contractor. Such measures include proper handling of fuels and lubricants, cleaning of debris immediately after construction. The time for partial reconstruction should coincide with the periods of low flow or its absence, i.e. from mid-may to mid-September.

144. **Culverts** – In the framework of the construction 9 old culverts will be require repair, reconstruction and replacement and 6 new culverts will be built. All culverts will have sufficient diameter to prevent congestion, and long enough, to accommodate additional carriageway lanes. As for the new culverts, their number was determined after proposals received from local residents..

145. The environmental impact associated with this work can be minimally reduced if the culvert pipes will be properly repaired, i.e. sufficient size and proper slope with the use of appropriate protective measures against erosion / leaching in the downstream. As far as possible, culvert works should be carried out in the dry season, because otherwise, the arrangement of temporary bypass canals will be required. However, some culvert pipes

provide irrigation water, which is supplied in accordance with the established irrigation schedule. Contractors will need to liaise closely with farmers in order to determine when work can be carried out without compromising crop growth.

146. Almost all structures should be concrete culvert pipes, prefabricated, with each section being installed on site and hermetically connected with a special compactor/ joint compound commercially available on the market.

(f) Disposal of construction material

147. During the reconstruction works removing existing old asphalt, it is planned to use it for adding internal roads located in adjacent villages. However, option of reusing old asphalt for construction will be considered. The contractor will use this option and will work to remove old asphalt with the special recycling equipment. The cost-effectiveness of reconstruction measures will increase significantly if the recycled material from the pavement is applied again. Disposal options will include hot recycling with and without new materials.

148. Prior to the commencement of the works, the contractor will submit revised calculations of the earth works (adjusted to the data provided in the biding documents) with an emphasis on the volumes of the old pavement to be removed. Steps for the removal of unused asphalt pavement will be included for their submission to the CSC.

(g) Contractor Good Housekeeping

149. Garbage and sewage and solid and liquid waste from equipment maintenance can be serious pollutants and disease vectors. The contractor will therefore need to practice good worksite and construction camp management. Inspections by the CSC environmental specialist will take place monthly and any no compliance issues such as strewn garbage, open waste pits, oil soaked ground and unsanitary washing facilities for workers, the contractor will be subject to a stop-work order if cleanup is not underway within 12 hours of detection. If the contractor does not take any action in this regard, the CSC will be asked to consider retaining an outside firm to clean up the area and this amount will be deducted from the contract total. The contractor shall ensure the disposal of household and liquid waste by specialized organizations having a corresponding permit and license. Temporary storage of household waste should be carried out on specially prepared sites and special storage facilities should be built for the polluted water used.

(h) Occupational Health and Safety

150. For health and safety protection of workers and adjacent communities, the following measures will be taken: (i) Adequate health care facilities (including first aid facilities) within construction sites; (ii) 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; (iii) Provision of personal protection equipment for workers, such as safety boots, helmets, gloves, protective clothing, goggles, and ear protection in accordance with KR legislation; (iv) Potable drinking water to all workers; (v) Adequate protection to the general public, including safety barriers and marking of hazardous areas; (vi) Safe access across the

construction site for people whose settlements and access are temporarily severed by road construction; (vii) Adequate drainage throughout the work camps so that stagnant water bodies and puddles do not form; (viii) Sanitary latrines and garbage bins in construction site, which will be cleared when reaching capacity. These will be emptied by the contractors to prevent outbreak of diseases.

151. As far as possible, the contractor will provide temporary collection and removal of garbage from construction sites to places of existing collection and disposal sites used by nearby local communities. This fact must be taken into account when deciding on the breakdown of the working camp. When using community utilities, the contractor will provide additional payment for such services.

152. 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.

153. The contractor shall provide information to workers, encouraging changes in individual's personal behavior and encouraging the use of preventive measures. The objective of the information given is to reduce the risk of HIV / STD transmission among construction workers, camp support staff and local communities.

Ecological Environment

154. Given the project work area is within the RoW of an existing Class 1 highway with no presence of ecological receptors, no significant ecological environmental impacts are foreseen, other the impact of the removal of thousands of mature trees, which has already been discussed in detail.

Social Environment

155. *Traffic and Congestion* – Traffic impacts of the road rehabilitation project will include disturbance of traffic along the road section. Prior to commencing operations, the contractor will review the material prepared by the Road Safety Consultant and provide a traffic management procedure to local traffic authorities, and publish information about scope and schedule of construction activities and expected disruptions and access restrictions. During the construction work the contractor will arrange for adequate traffic flow around construction areas, including providing traffic control staff or and diversion signaling as required.

156. *Pedestrian and livestock crossings* – in addition to the planned crossings for people and animals after the opening of the restored road, it will also be necessary to organize the crossing points during the construction works. In order to address this issue, the contractor will need to develop an internal program to ensure the passage of people and animals bypassing the work sites and crossing the road during the construction period. The program should be made available at any time at the request of the inspector acting on behalf of the Consultant.

157. *Occupational Health, Safety and Hygiene* – It is possible that the operation of construction camps could have public health impacts. There will be a potential for diseases to be transmitted, exacerbated by inadequate health and safety practices. Therefore, the contractor will be required to recruit a health and safety specialist to address such concerns at all camps. If mitigation of health and safety concerns arise and the CSC suggests it is necessary, the contractor's specialist shall also liaise/work with the nearby communities.

158. *Mitigation measures* will include: (i) provision of adequate health care facilities within construction sites; (ii) a health and safety specialist, appointed by the contractor for each camp, and first aid equipment and facilities; (iii) training/orientation of all construction workers in basic sanitation and health care issues (e.g. HIV/AIDS and other sexually transmitted infections), general health and safety matters, and on the specific hazards of their work prior to commencing operation; (iv) distribution of personal protection equipment for workers, such as safety boots, helmets, gloves, protective clothing, goggles, and ear; (v) provision of clean drinking water to all workers; (vi) protection to the general public, including safety barriers and marking of hazardous areas in accordance with relevant legislation and regulations; (vii) safe access across the construction site to people whose settlements and access are temporarily severed by road construction; (viii) adequate drainage throughout the camps to ensure that disease vectors such as stagnant water bodies and puddles do not form; an; (ix) Septic tank and garbage collection box will be set up at the construction sites, and will be cleared according to a weekly schedule posted by the contractor.

Operation Phase

A. Physical Environment

Air Quality and Noise Level

159. *Air Quality* – The proposed project will likely result in better road condition, increase of traffic volumes along this road section. This is a function of the growth rate and vehicle ownership in the country, not the widening of the road. M39 highway is the only route connecting North and South, so divergence to other routes that are in worse condition than the existing one seems unlikely, as transport drivers will not use these alternative unpaved and unsafe roads.

160. As noted earlier, traffic is projected to grow by 7% per year for passenger transport, and by 4% per year for freight transport and buses. With this growth, which is projected to increase by 15,000 vehicles per day by 2020 (table 6), the number of older vehicles with more pollution will decrease from the entire fleet, there will be less congestion, because of improved road conditions and traffic control, improved engine technology and a much greater proliferation of vehicles with efficient fuel consumption. In addition, the Kyrgyz Republic will receive higher quality fuel with lower emission factors per liter of fuel. The air in the airspace of the transport corridor is heavily polluted (table 14). These conditions can be improved through annual inspections, especially for small and large buses, which account for the majority of exhaust gases. Secondly, the use of exhaust gas neutralizers and other devices reduce the level of pollution should be made mandatory and to be fixed by local law.

161. High quality road with appropriate signs and markings of traffic lanes, as well as with a proper intersection management system, will provide for more smooth movement of vehicles and, thereby, reduce the high rate of the exhaust gas due to frequent acceleration and deceleration speed.

Table 17 Traffic projection (AADT) road sections

Year	**Bishkek - Kara-Balta**
	km 8.5 – km 15.9
2013	41,996
2018	49,398
2020	55,348
2030	65,103
2038	65,103

Source: Kock's Consultant's 2013 estimations

162. Road safety equipment will be installed along the road, such as street lighting, traffic lights at pedestrian crossings, livestock driving and other visual means.

163. **Noise –** The noise survey completed in June 2015, showed that noise levels along the project corridor and for about 20-50m on either side of the carriageway, far exceed the KR standards for even commercial industrial land uses (Table 21). Currently, the existing noise level interferes with sleep and affects schools and hospitals.

164. During operation, noise measurements should be carried out in places where sensitive receptors are located. The monitoring results will be used to monitor and, if necessary, apply additional most appropriate noise reduction measures. Summarizing the results of the Noise Modeling research the following is being proposed to reduce the impacts to an acceptable level during operation: laying of new asphalt (Porous asphalt; pores >15% 0/11 and speed limit from 60 km / h to 50 km / h. Detailed information is provided as part of the Noise Modelling Report attached as part of Annex 2 in this SIEE.

Soil and Erosion Control

165. The soil erosion problems associated with the road would be minor if the contractor properly implemented all the measures, defined in EMP, during the construction period, and the consultant's environmental specialist will audit the protective measures after construction in order to confirm that all mitigation measures have been implemented and were still being implemented. It will be important to confirm that the topsoil and vegetation are being restored as the work is completed (not after construction is completed), trees have been planted, and these trees are in good condition and are being maintained. On the engineering side, inspection of the culverts will be critical since their placement at too steep an invert slope will result in serious and chronic downstream (exit) scouring. To avoid this the invert slope should be at the same grade as the natural water body and a concrete pads or preferably energy dissipation installations such as large rocks and rock gabions, should be installed.

166. Further, culverts need to be inspected to ensure that all debris and construction materials have been removed and any stream diversion structures have been completely

removed. In this regard, the Consultant and IPIG will prepare culverts sheet with photos of each pipe, its condition at the time of the inspection, which should be carried out on an annual basis and will be submitted to the MoTR. It will take two photos of each culvert, one for the end of the upstream and the other for the downstream.

167. MoTR will instruct this work to the contractor during the one-year defect period, after the full operational commissioning of the road, and then after this period, this task will be transferred to the MoTR' maintenance Department.

B. Ecological Environment

168. The only ecological issue that could arise during the operating period is a failure to properly maintain the large tree plantations. The local ecosystem will be significantly altered by the cutting of the trees and therefore the replanting and tree maintenance program, until the trees are at least 9-10 years old will be critical to re-establishing the pre-cutting conditions of roadside shade during the summer and windbreaks during the winter. The roadside trees, admittedly planted many decades ago, are the only mature tree assemblage within many km of the alignment. It has a microclimate and huge benefits for people living under them or benefiting from their shade and shelter. Therefore, as stated many time in this Supplementary IEE, cutting should be minimized to the greatest extent possible by using innovative designs that build the trees into the road structure. Planting will be done at a ratio of 1:3.

C. Socio-Economic Environment

169. Pedestrian safety improvements are expected through the restoration of existing sidewalks and pedestrian crossings. During the construction period, this issue will be given special attention and all measures will be taken to ensure the safety of pedestrians by arranging and marking temporary pedestrian crossings, installing temporary signs, etc..

170. MoTR proposes to include pedestrian crossing facilities such as improved yellow signaling installations at pedestrian crossing points, repair of existing and construction of new underground pedestrian crossings near school, hospital, and pedestrian overcrossing.

171. Resettlement – Commercial objects, part of the base (Bazaar "Nurlan"), a gas station, and some fences fall under the relocation. More detailed information on the objects falling under the "resettlement" is listed in the Resettlement Plan. Compensation will be paid to persons affected by the project prior to the start of construction.

Benefits

172. The project will generate many benefits, and the six most important ones are listed follows:

- Better road and reduced travel time, Fewer delays, better access to markets;
- Quieter road, due to pavement upgrading and use of a noise attenuating pavement formulation;
- Safer road, through the provision of good signage, street lighting, separate sidewalks along the road in urban areas and arrangement the crossings for animal.

VI ANALISYS OF ALTERNATIVES

“No Project” Alternative

173. For the current project, “no project” alternative was not an acceptable option. Given that the shipment of goods to the south part of the Kyrgyz Republic, as well as international transit of goods take place at this section, the project section of the national M39 highway has a high traffic intensity with a volume of more than 45,000 vehicles per day. Road markings are in very poor condition, road shoulders are not provided everywhere (in most cases gravel, poses a risk), the road pavement has a very rough surface. Here is the highest rate of accidents in the country. The road section is the most important link of transport connection between the two main cities of Kyrgyzstan. According to the forecast, the traffic intensity in this section will increase.

174. Due to the complex topography, land use, hydrogeological formations/phenomena, i.e. mudflow conditions and land seizure, the construction of a new road was not considered.

175. Exploitation of the rail transport potential of the Kyrgyz Republic would require construction of major new lines, namely, the so called 'China – Kyrgyzstan – Uzbekistan' or ‘North - South’. This railway line would link Bishkek, Balykchy and Torugart connecting Kyrgyzstan’s northern and southern regions to each other and to surrounding countries and regions including China and the Middle East; and an East West railway connecting Aral on the North South line with Osh and Uzbekistan. In addition to the effective connection of isolated regions, these lines are also designed to provide access to mineral resources in the center of the country. Development projects on this scale would require huge investment and would likely be prohibitive for the Kyrgyz economy. Therefore, now, massive costs make these alternatives less attractive for Kyrgyzstan.

176. Due to a certain “complexity” of the development of the railway network for several reasons, improving the railway network is not enough to relieve the traffic load, and therefore the preferred alternative solution is to improve the main highways, including the complete pavement replacement of the M39. Another attractive feature of road over rail is that the roadwork will take three years as opposed to 5-7 years for a rail project.

177. The new 7.4 km road section (from 8.5 km Bishkek Border to 15.9 km) is a "junction / exit" to the national M39 highway (the northern bypass of Bishkek passes on the M39 highway) and also adjoins the Bishkek-Osh road at km 15.9 and can be considered integral part of the entire road, therefore rehabilitation is being proposed.

Alternative Designs

178. Alternative options have focused on at least 11 design elements, addressing all aspects of the work. These 11 elements were carefully assessed in the Feasibility Study, and include:

i. Geometric design standards
ii. Intersection and junction planning

iii. Road signage and markings
iv. Crash barriers
v. Parking and bus stop areas
vi. Sidewalks and shoulders
vii. Street lighting and stoplights
viii. Roadside toilet facilities
ix. Protection of utility lines
x. General road safety
xi. Bridge and culvert rehabilitation

179. As part of the Feasibility Study engineers evaluated 11 design elements, including considerations of cost and technical validity, and then recommended a preferred approach for each of the elements, but no decision on a specific preference. Choosing the best design will be completed as part of the detailed design and construction drawing preparation stage.

180. Environmentally relevant design limits incorporated into this project were that there would be no alignment deviations, no work outside the existing RoW, maximum reuse of old asphalt–concrete, tree removal kept to a minimum, based on a tree management plan, prepared by CSC and the Contractor, and as the work progresses, the implementation of the main program for planting of 3-5 year tree saplings should begin.

The Preferred Alternative for the New Section

181. The preferred, alternative will see the construction completed in 2 years, all work undertaken within the existing road RoW, and as much of the more than 200 thousand m^3 of asphalt concrete to be removed from the 4-6- lane highway, with more than 7.4 km length, and will be reused. Further, the removal of trees will be kept to an absolute minimum as they contribute enormously to summer road temperature amelioration, shade for roadside residences and businesses and process CO_2 (at least during their growing years). In the winter these trees act as a significant windbreak, since much of the tree cover in the surrounding land has been removed.

VII INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION

A. Process of public consultations and information disclosure

182. Initially, when preparing the feasibility study for the project "CAREC Corridor (Bishkek-Osh) Improvement Project, Phase 4" in June 2013 public consultation meetings were organized with representatives of the public, with participation of residents of the surrounding in Voyenno-Antonovka village. The results of the meetings are presented in Annex 1. In the table below there is a brief description of the meetings. After determining the preliminary cost of the project, the section of the road km 8.5 - km 15.9 was excluded. However the information from this public hearings was kept.

183. MTR KR will prepare other environment-related documents available in accordance with Kyrgyz and ADB requirements for disclosure. After approval the SIEE by MTR KR and ADB, this report will be disclosed on ADB and IPIG/MOTR websites as a supplementary report to the IEE for the main project (CAREC Corridor (Bishkek-Osh) Improvement Project, Phase 4).

184. Also required to conduct a State Environmental Review by the State Ecological Expertise of the State Agency of Environmental Protection.

Table 18. Summary Table on public consultation June 2013

Time	Venue	Participants	Issues discussed	Answer and suggestions for incorporation
June 10,2013 9:00 am 10:20 am	Voenno-Antonovka village, conference hall of Voenno-Antonovka rayon Administration	IPIG/MOTR Asylbek Abdygulov ES Kock's Consult Vasiliy Chernyh Deputy Team Leader, Nurul Hoque Sociologist Erik Shukurov Ecologist	Asylbek clarified that within the framework of the project it is planned to implement the Grievance Redress Mechanism. This step is intended to improve and accelerate feedback to the public. Asylbek also spoke about the development of measures to reduce environmental impact. To raise public awareness, it is planned to distribute information brochures containing information on the socio-economic, environmental and engineering aspects of the Bishkek — Osh road rehabilitation project.	
			Who will be the contractor?	The contractor will be determined by the results of the Bidding. It can be both local and foreign company.
			How will old asphalt be used?	Old asphalt will be used as follows: 50% will be used for construction needs, 50% - for the needs of the local community (repair of adjacent roads, etc.).

Time	Venue	Participants	Issues discussed	Answer and suggestions for incorporation
			Will there be installed traffic lights, street lighting? How will the roadbed and adjacent territory be equipped?	The project includes installation of traffic lights. The project also includes construction of sidewalks, ditches and drainage water courses. In addition, it is planned to pave the adjacent roads to a depth of 30-50 meters and the exits to the houses's fences. Sidewalks will be equipped with ramps. The road cross-section will be raised, reinforced concrete trays will be installed at the roadsides, and all necessary engineering work will be carried out to improve the safety of the roadbed. It is planned to increase the number of stopping points and re-equip them. All road construction works are carried out in accordance with all standards, construction supervision consultant monitors the entire process of construction. The service life of the road is about 15 years.
			Who will be the contractor?	The contractor will be determined by the results of the Bidding. It can be both local and foreign company.
			How will old asphalt be used?	Old asphalt will be used as follows: 50% will be used for construction needs, 50% - for the needs of the local community (repair of adjacent roads, etc.).
			What is the expected increase in traffic?	The estimated increase in road capacity is 4% per year over the next 20 years.

Time	Venue	Participants	Issues discussed	Answer and suggestions for incorporation
			Has the question of the construction of a bypass road been discussed?	The estimated cost of construction of new road is double expensive then rehabilitation of old road pavement. Besides there is a moratorium on seizure and transformation of the agricultural land
			Will be the subways, drainage structures, and auxiliary roads rehabilitated/constructed to relief the main road?	The subways would be rehabilitated: extended, strengthened, and furnished. After the rehabilitation they would be maintained by local governments. Also the project includes construction of sidewalks, channels and drainage chutes. No additional auxiliary roads.
			What will happen to the trade outlets occurred within the project implementation zone?	All kiosks built in a light construction will be temporary shifted from the construction side and returned back upon completion of the project. Capital structures most likely will be removed. Big trade complexes will be provided with access roads. Parking is not foreseen. Construction works will cause only temporary impact by hindering access to these complexes.

Time	Venue	Participants	Issues discussed	Answer and suggestions for incorporation
			How will the construction works influence on the environment of Voenno-Antonovkla village? What about the current situation with maximum permissible concentration of harmful substances in vehicle emissions, noise and vibration? Is there is an excess?	Without doubt in the course of rehabilitation works the dust level will increase as well as other emissions since along with the usual traffic flow some heavy road construction equipment and heavy trucks will be engaged. At present we have no any data on air quality, noise and vibration. In the nearest future certain measurements will be taken. The results of those measurements will be used as a basic reference environment data and will being compared with the results of the following measurements. The environment condition will be monitored within the settlements through which the road passes.

III GRIEVANCE REDRESS MECHANISM

A. Grievance Redress Mechanism

Objections

185. Grievance redressing mechanism will be established to allow APs appealing any disagreeable decision, practice or activity arising from implementation of CAREC Corridor 3 (Bishkek-Osh Road) Improvement Project Phase 4 (45169-002) financed by ADB. APs will be fully informed of their rights and of the procedures for addressing complaints whether verbally or in writing during consultation, survey, and time of compensation and implementation of the project. Care will always be taken to prevent grievances rather than going through a long redress process.

186. The GRM will cover issues related to social, environmental and other safeguard issues under ADB safeguard covenants and Kyrgyz law.

b) Grievance Redress Group (GRG)

187. The Grievance Redress Group (GRG) will be established for the duration of project implementation. The GRG is tasked with all activities needed to discuss a grievance, assess its validity, assess the scope of eventual impacts, and decide eventual compensation needed and instruct/facilitate the functioning of the grievance redress mechanism.

b.1 Functioning of The GRG within the Grievance Redress Mechanism

188. The GRG operates within a grievance redress mechanism (GRM) which is a two-stage appeal process:

Stage 1, Local (Village) Level

189. The grievances will be first lodged at the level of the complainant's village community. The complainant will report his case to the Local Point of Contact (LPC) The LPC will trigger the action of the Grievance Redress Group (GRG) which will assess the situation and seek a solution through consultation with complainants, local Roads Maintenance Unit (RMU) the oblast Ombudsman, and the selected AP representative.

Stage 2, Central Level

190. In case within additional 15 days the grievance is still not resolved at local level the complainant will further raise the issue to MOTR's headquarters in Bishkek again with the support of the LPC, AP representatives, and the oblast Ombudsman. The GRG will decide on the eligibility and on the complaint case and prepare the resolution, subject to IPIG/MOTR consent.

191. GRM proceedings will entail one or more meetings for each complaint and may require field investigations by specific technical or valuation experts. Grievance cases shared by more than one complainant may be held together as a single case.

192. For deliberations at the local level, the meetings will be held in the village of the complainant. For appeals at central level the meetings will be carried out at in MOTR office in Bishkek with field trips of GRG members to the village of the complainant.

b.2 Composition of GRG

193. GRG is established by the order of MOTR. The GRG is composed at different levels of appeal by the following individuals/officers.

GRG local level

194. GRG will be established by the order of MOTR. The GRG is composed at different levels of appeal by the following individuals/officers:

Table 19 Composition of local GRGs

Members	**Position**
Head of Ayil-Okmotu	LPC
Representative of the RMU	Member
2 Representatives of APs	Members
Ombudsman of the Oblast	Member

GRG Central level

195. The central level GRG will be represented by 6 members of the following composition.

Table 20 Composition of Central GRG

Members	**Position**
Head of IPIG of MOTR	Chairperson
IPIG Project Coordinator	Member
Representative of IPIG safeguards unit (environment)	Member
Representative of IPIG safeguards unit (resettlement)	Member
Representative of the RMU	Member
Ombudsman of the Oblast	Member

196. At each level of appeal, the GRG will be assisted as needed by the professional person who will help to solve each specific case. These professionals could include a representative from the:

- State Rayon Administration Representatives
- Representatives of Rayon Branch of the State Agency for Architecture and Construction
- State Registration Services of the Rayon
- Ministry of Agricultural
- State Agency for Environment and Forestry
- Ministry of State Property
- Technical expertise from professional engineers.

b.3 Duties of GRG Members

Local Point of Contact (LPC) / Head of Ayil-Okmotu

197. Once the LPC Receives written notification of a complaint s/he will:

- draft a complaint memo to be signed by the complainant and the LPC indicating name of complainant, date and place of presentation of complaint, description of complaint and supporting documents, if any;
- send the complaint memo to all members of the local level GRG, summon them for a GRG meeting and establish the date of the first and (if needed following) grievance redress meetings;
- request village authorities to organize the meeting(s);
- chair the GRG meetings;
- convey requests and enquiries of the complainants to IPIG/MOTR and to the other members of the GRG at village level;
- maintain records of each meeting and each communication between him/her and the complainants;
- participate as a witness to appeal cases at all levels;
- ensure the administrative and organizational support for GRG members to work;
- disseminate the information on the GRM across the local communities concerned.

RMU Representative

198. Once notified of a complaint and summoned by the LPC to a grievance meeting the RMU representative will:

- contact the complainant(s) and draft a note with his/her understanding of the complaint;
- recording of complaints and submitted documents of proof;
- participate to all grievance meetings, provide opinions and analysis, take minutes of the discussions;
- accompany eventual assessment/valuation specialists in the field;
- based on the position reports of GRG members and on his/her understanding of the case prepare the final grievance report and recommendations to be sent to complainant, other GRG members and IPIG. The report may indicate that: i) the case is solved without further action; ii) that the case is solvable but requires compensation or other action or iii) that the case remains unsolved;
- if the complaint is considered valid and the needed compensation/action is approved by IPIG, proceed for the delivery or compensation or for the execution of the redress action;
- when prompted by the LPC that a complainant with an unsolved grievance wants to lodge the complaint at a higher appeal level inform IPIG/MOTR and proceed with the organization of the central level appeal meeting.

Representatives of the APs

199. Two representatives of the APs from the affected community will participate in all GRG meetings and will:

- participate to all grievance redress meeting;
- provide relevant information related to the submitted complaints;
- provide other GRG members as relevant with a position note to be reflected in the final meeting report.

Ombudsman

200. Once notified of a complaint and a summoned by the LPC to a grievance meeting is submitted the Ombudsman will:

- monitor complaint handling process and ensure that decisions made by the GRP are equitable and objective;

- provide independent opinions and recommendations related to the decision made on the case by the GRP team;
- advise the complainant(s) on their rights and entitlements, as necessary;
- participate to all GRG meetings and site visits;
- participate in eventual assessment/valuation in the field (if necessary);
- prepare a position memo at the end of the meeting(s) and forward it to LPC/chairperson of the GRG.

GRG Chairperson / Head of IPIG MoTR

201. Once notified that a complainant has lodged an appeal case at central level, the GRG chairperson will:

- contact the complainant(s) and draft a note with his/her understanding of the complaint;
- trigger the GRG members through a letter of invitation;
- chair the GRG meetings and ensure that minutes of the meeting are shared with all relevant parties;
- review the content of each response prepared after deliberations to ensure accuracy as well as consistency of answers provided to the complainants;
- ensure the administrative and organizational support for GRG members to work;
- support the decision made by the GRG and ensures that the follow-up actions are taken.

IPIG Project Coordinator

202. Once notified that a complainant has lodged an appeal case at central level project coordinator will:

- contact the complainant(s) and draft a note with his/her understanding of the complaint;
- participate to the appeal meeting, provide opinions and analysis, take minutes of the discussions;
- if needed summon again assessment/valuation specialists and accompany them in the field;
- request the chairperson to organize meetings, as necessary;
- maintain communication between GRG and the complainants.

Representatives of IPIG Safeguard Unit

203. Once notified that a complainant has lodged at central level, the representatives of IPIG safeguard and technical unit will:

- record the complaint to understand sequence of developments prompting the complaint;
- provide environmental and resettlement opinion on impacts claimed by the claimant;
- request the chairperson to organize meetings, as necessary;
- maintain communication between GRG and the complainants.

Technical Experts

204. Once summoned to provide expert advice for the assessment or valuation of an impact claimed by a complainant the relevant technical expert will carry out the needed investigations and prepare a report to be handed to the complainant and the other members of the GRG. The tasks will include:

- provision of relevant technical opinion for the case reviewed;

- carry out the needed investigations relevant to their expertise;
- provide recommendation when the legal opinion from the relevant state agencies is necessary.

B. Grievance Resolution Process

205. The LPC of GRGs will be regularly available and accessible for APs to address concerns and grievances. He will assist the aggrieved APs in formally lodging their claims to the GRG. The complaints and grievances from the APs will be addressed through the process described below.

Table 21 Grievance resolution steps

Steps	Action level	Process
Step 1	Negotiation	At initial stage, the LPC will give hearing to the aggrieved person and try to give acceptable solutions. If any aggrieved AP is not satisfied with the solutions, then the aggrieved AP will lodge grievances in written to the concerned local GRG within 7 days.
Step 2	Resolution of grievance at the level of local GRG	After receiving written complaints of AP the LPC will review and prepare a Case File for GRG hearing and resolution. A formal hearing will be held with the GRG at a date fixed by the LPC in consultation and the aggrieved APs. On the date of hearing, the aggrieved AP will appear before the GRG at the office of concerned Ayil-Okmotu and produce proof in support of his/her claim. The LPC will note down the statements of the complainant and document all proof. The decisions from majority of the members will be considered final from the GRG and will be issued by the LPC and signed by other members of the GRG. The case record will be updated and the decision will be communicated to the complainant AP by the LPC within 15 days of submission. If any aggrieved AP is not satisfied with the solutions, then the LPC will lodge grievances in written to the central GRG at MOTR with conclusion and supporting documents prepared at local level.
Step 3	Resolution of Central GRG	After receiving written complaints of AP the GRG Chairperson of the central GRG will review and prepare a Case File for GRG hearing and resolution. A formal hearing will be held with the GRG at a date fixed by the GRG Chairperson and the aggrieved APs. GRG members will contact the complainant and visit his village. The IPIG Project Coordinator will note down the statements of the complainant and document all proof. The decisions from majority of the members will be considered final from the GRG and will be issued by the GRG Chairperson and signed by other members of the GRG. The case record will be updated and the IPIG Project Coordinator will communicate the decision to the complainant AP within 15 days of submission.

206. If the grievance redress system fails to satisfy the aggrieved APs, then they can apply to the appropriate court at their own cost for desired remedy at any time and stage. The APs have access to ADB Accountability mechanism at any stage after their concerns have been registered with the GRM log.

207. Grievance redress process as bellow.

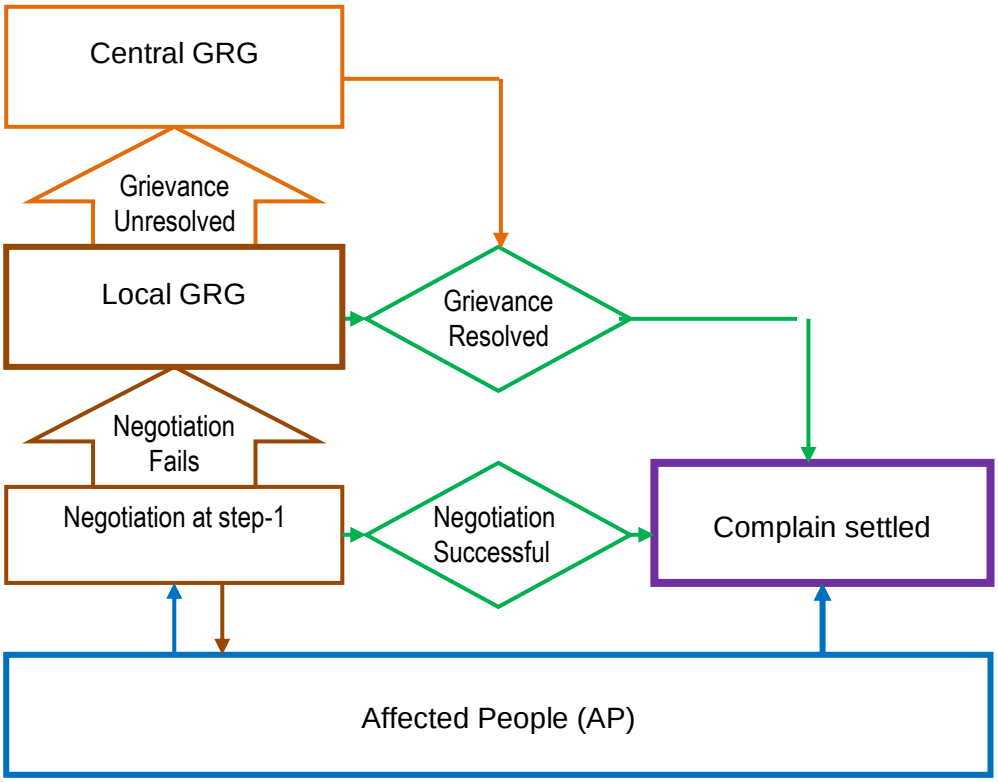

Figure 5. Grievance redress process

C. GRG Reports and Documentation

208. IPIG of MOTR will maintain record of all complaints for regular monitoring of grievances and results of services performed by the GRGs, and for periodic review of ADB.

IX. ENVIRONMENTAL MANAGEMENT PLAN

A. Organizational structure

209. The relevant institutional entities for the project include the Ministry of Finance (MOF), Ministry of Transport and Communication (the EA), Investment Projects Implementation Group (IPIG) under MOTR, State Agency of Environment Protection and Forestry (SAEPF), State Inspection on Ecological and Technical Safety (SIETS), Department for Disease Prevention and State Sanitation and Epidemic Control of the Ministry of Health Protection.

210. MOTR is responsible for transport sector development and is the EA for the project. MOTR has overall responsibility for planning, design, implementation, and monitoring of the project. IPIG is working under MOTR and will carry out the responsibilities assigned to MOTR.

211. MOF is the responsible government body for coordination on donor assistance with ADB and other donors regarding external assistance issues.

212. SAEPF is a leading state environmental agency responsible for the environmental policy of the country and coordination of environmental activities of other state bodies. Its functions include:

- Development of environmental policy and its implementation;
- Carrying out a state environmental expertise;
- Issuance of environmental licenses;
- Environmental monitoring;
- Delivery of environment information services.

213. SETI carries out its activity in accordance with the Law "On Procedure for inspection of business entities". SETI exercises control over compliance in established order of:

(i) environmental legislation, set rules, limits and standards of environmental management, standards for emissions and discharges of pollutants and waste disposal in the environment;
(ii) requirements of industrial safety in the construction, expansion, reconstruction, modernization, operation, conservation and liquidation of hazardous production facilities;
(iii) requirements of land legislation;
(iv) requirements for safe operation of equipment and facilities for storage and distribution of petrochemicals and gas, cranes;
(v) requirements of rules of safe operation at construction, installation and adjustment of electric networks and electric equipment.

214. The Department for Disease Prevention and Sanitary-Epidemiology Supervision supervises sanitary and epidemiological welfare of the population, safety of goods and products, environmental compliance and conditions, prevention of harmful impacts on the environment and human health.

215. There is a sector of non-governmental organizations formed in Kyrgyzstan, which actively participate and sometimes lead in environmental management issues in the country.

216. Responsibilities for the implementation of the monitoring requirements of this report are summarized in Table 25 (the Environmental Mitigation Monitoring Plan (EMP)).

217. In order to comply with the EMP and Monitoring plan during Project implementation, the CSC and IPIG will undertake the following tasks:

(i) The bid process and contract documents will clearly set out the contractor's obligations to undertake environmental mitigation measures set out in the Environmental Management Plan.

(ii) The recommended environmental mitigation costs are included as separate items in the Bills of Quantities. This will ensure that there is specific environmental mitigation budget, which will be implemented as required. During the procurement, contractors will be encouraged to include these costs in their rates and present the mitigation cost as a line item in the Bill of Quantities. There will be an identified extra payment in the contract to ensure measures are costed and carried out.

(iii)The contractor will recruit an environmental, health and safety officer, who will be responsible for implementing the contractors' environmental responsibilities. The manager will also be responsible for health and safety aspects of work sites. Before commencing physical construction, the Contractor will prepare an Construction Environmental Management Workplan (CEMWP) to CSC for endorsement and IPIG for approval.

(iv) CSC will conduct environmental monitoring and assist IPIG in implementing EMP and supervising the implementation of mitigation measures by the contractors.

B. Reporting Requirements

218. MOTR (IPIG) with the support of the Consultant will monitor works on compliance and execution of protective measures specified in the EMP. Monitoring results will be reflected in monthly progress reports. In this regard construction period semi-annual monitoring reports will be prepared by the CSC and submitted to MOTR within 1 month after the reporting period. Then disclosed on the ADB and MOTR websites.

C. Environmental Management Plan

219. This EMP covers for the new section of the road and describes the various measures designed to avoid, mitigate, or compensate the adverse environmental impacts on all physical, ecological and human resources within the project's corridor of impact. As such the EMP considers all phases of the Project cycle, namely the detailed design, construction and the operational phases.

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

221. The EMP consists of two tables. Table 18 provides brief information on measures to reduce environmental impacts, and Table 19 sets out General information about environmental monitoring. At the end is a provision including a time frame and commitment for environmental monitoring.

Table 22 Environmental Management Plan

MITIGATION MEASURES DURING THE CONSTRUCTION AND OPERATION PERIOD				
Type of activities	**Potential impact**	**Mitigation measures**	**Institutional responsobility**	
			Implementation	**Monitoring**
CONSTRUCTION PERIOD				
Preservation of topsoil.	Loss of topsoil.	Removing of top soil occurring within site 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 sawn with a fast growing vegetation, e. g. grass	Contractor	Construction Supervision (CS), Safeguard Department of IPIG/MoTR
Road alignment in areas of tree plantations. Embankment filling of the tree stem area.	Tree cutting to embankment fill	A maximum fill up of the tree stem area of 30 cm can be accepted. Fill up material in the tree stem area has to be organic soil. A filling up of more than 30 cm will damage the tree. In this case cutting can't be prevented and a new tree is to be planted as a compensation measure at the respective location within the existing RoW. Species to planted are nut (Juglans regia) or poplar (Populus nigra). Tree planting should be carried out after the completion of technical works at certain times of the year – in spring (March to April) and/or autumn (October to November). Quality of newly to be planted trees shall be 16 to 18 cm of stem circumference at least in 1,5 m height. Planting ratio – 1:3	Contractor	Construction Supervision (CS), IPIG/MoTR
Bottom of embankment of designed road lying very close to tree rows.	Potential damaging of trees during construction activities	Implementation of a temporary vegetation protection fence during construction activities.	Contractor	Construction Supervision (CS),
Operation of borrow-pit areas / quarries	Potential disfigurement of landscape, vegetation losses and damage to access roads. Increased dust emissions.	Environmental impacts concerning potential disfigurement of landscape, vegetation losses and damage to access roads are kept to a minimum. Wet aggregates and/or provide cover on	Contractor	Construction Supervision (CS), IPIG/MoTR

MITIGATION MEASURES DURING THE CONSTRUCTION AND OPERATION PERIOD				
Type of activities	**Potential impact**	**Mitigation measures**	**Institutional responsobility**	
			Implementation	**Monitoring**
	Siltation and obstruction of surface waters.	haul trucks to minimize dust emission and material spillage. Locate stockpiles away from surface waters. Prior to start material extraction, the contractor shall submit its SEMP to the Safeguard Department of IPIG/MoTR (Through the person responsible for construction supervision) 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. It is necessary that the SSEMP address the sensitive issues of avoidance of transportation thru residential areas as far as technically feasible and closure rehabilitation.		
Operation of the aggregate crushing plant (aggregate crusher).	Increased dust and noise emissions.	Careful site selection of aggregate crusher in order not to interfere with any sensitive receptor. Distance to next settlement and residential houses at least 300 m downwind. Site selection for aggregate crusher has to be approved by the Safeguard Department in the IPIG of the MOTR.	Contractor	Construction Supervision (CS), IPIG/MoTR
Operation of the asphalt plant	Odour emission and safety risks.	Asphalt plants shall be 500 m downwind from any settlements and residential houses. 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.	Contractor	Construction Supervision (CS), IPIG/MoTR

MITIGATION MEASURES DURING THE CONSTRUCTION AND OPERATION PERIOD				
Type of activities	**Potential impact**	**Mitigation measures**	**Institutional responsobility**	
			Implementation	**Monitoring**
		Secure official approval for installation and operation of asphalt plants from MOTR.		
	Water pollution due to the spill of bitumen.	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. 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.	Contractor	Construction Supervision (CS),
Selection and preparation of site, operation of storages for construction materials of the contractor.	Potential contamination of soil and water.	The contractor shall submit documents for approval (short statement and site plan in appropriate scale) which indicate: • 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, providing regular collection and disposal of waste in a hygienic manner, as well as proposed waste disposal sites for different types of waste (for example, household waste, worn tires, etc.), and consistent with the requirements of relevant regulations. • Description and plan of sites for Description and layout of equipment maintenance areas and lubricant and fuel storage facilities including distance from	Contractor	Construction Supervision (CS), IPIG/MoTR

MITIGATION MEASURES DURING THE CONSTRUCTION AND OPERATION PERIOD				
Type of activities	**Potential impact**	**Mitigation measures**	**Institutional responsobility**	
			Implementation	**Monitoring**
		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. The selected site will not be on top of ground water area or near surface waters.		
	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),
Selection and preparation of site, operation of storages for construction materials of the contractor (continuation)	Risks to the health and safety of workers and nearby communities.	For health and safety protection of workers and adjacent communities the following shall be provided: • 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 protective equipment for workers, such as safety shoes, helmets, gloves, protective clothing, safety glasses and headphones in accordance with the law; • clean drinking water for 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	Contractor	Construction Supervision (CS), IPIG/MoTR

MITIGATION MEASURES DURING THE CONSTRUCTION AND OPERATION PERIOD				
Type of activities	**Potential impact**	**Mitigation measures**	**Institutional responsobility**	
			Implementation	**Monitoring**
		construction; • safe access across the construction site to people whose settlements and access are temporarily severed by road construction; • toilets and waste bins at the construction site, which the contractor will periodically clean to avoid outbreaks of epidemics. Where possible, the contractor will arrange for the temporary integration of waste disposal from work sites with existing waste collection systems and disposal facilities in nearby communities.		
Work site operation / Operation of equipment maintenance and fuel storage areas	Workers health and soil / water pollution.	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. 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. Store and dispose waste/used oil consistent with environmental legal	Contractor	Construction Supervision (CS), IPIG/MoTR

MITIGATION MEASURES DURING THE CONSTRUCTION AND OPERATION PERIOD				
Type of activities	**Potential impact**	**Mitigation measures**	**Institutional responsobility**	
			Implementation	**Monitoring**
		requirements. 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 levelling of stored top soil).		
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, as infrastructure and associated transport services give people and infections mobility.	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 construction workers, camp support staff and local communities.	Contractor	Construction Supervision (CS), Ministry of Health
Earthworks and various construction works	Loss of topsoil	Topsoil on the sections to be used as a stockpile for surplus construction material shall be removed and stockpiled to reuse them to cover these areas upon completion of works. 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)
Earthworks and various construction works (continuation).	Siltation of surface water and / or soil impact due to / or improper disposal of excess material.	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	Contractor	Construction

MITIGATION MEASURES DURING THE CONSTRUCTION AND OPERATION PERIOD				
Type of activities	**Potential impact**	**Mitigation measures**	**Institutional responsobility**	
			Implementation	**Monitoring**
		to identify sources of water (for spraying and other construction requirements) that will not compete with the local community.		Supervision (CS),
	Air pollution due to exhaust emissions during construction equipment operation.	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 and vibration levels.	Limit work from 08.00 am to 19.00 PM within 500 m from settlements. In addition, a limit of 70 dBA is established and strictly observed near the construction site.	Contractor	Construction Supervision (CS),
	Soil compaction due to the work of heavy equipment.	Limit the operation of heavy equipment within the project corridor, which is essential for the road construction, in order to avoid soil compaction and agricultural used land close to the road.	Contractor	Construction Supervision (CS),
Earth works and various construction activities (continuation).	Creating inconveniences for traffic flow	Submit a traffic management plan to local traffic authorities prior to mobilization. Provide to local community information on the scale and schedule of construction works, as well as expected violations of the usual way of life and restrictions on access / travel / passage. 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.	Contractor	Construction Supervision (CS), local / regional Department of MoTR
Within settlements, encroachment into private and residential land.	Dislocation or involuntary resettlement of people.	The Resettlement Specialist will issue the Land Acquisition and Resettlement Plan (LARP) providing the assessment of losses and compensation procedure.	MOTR	MOTR

MITIGATION MEASURES DURING THE CONSTRUCTION AND OPERATION PERIOD				
Type of activities	**Potential impact**	**Mitigation measures**	**Institutional responsobility**	
			Implementation	**Monitoring**
Within settlements, encroachment on business assets and / or Disturbance to business, people, activities and socio-cultural resources due to construction work	Loss of businesses and income of people operating their business within the existing RoW.	The Resettlement Specialist will prepare the LARP, providing the assessment of losses and compensation procedure. The following mitigation measures should also be implemented Inform all residents and businesses about the nature and duration of work well in advance so that they can make necessary preparations Limit dust by removing waste soil quickly; by covering and watering stockpiles, and covering soil with tarpaulins when carried on trucks. Increasing workforce and use appropriate equipment to complete the work in minimum time in the important areas. Do not carry out construction work near religious sites during important periods, such as holidays.	MOTR	MOTR
Within settlements disproportionate encroachment on poor people's assets.	Loss of wealth and property of poor people. Poor and vulnerable households might be affected.	The Resettlement Specialist will prepare a LARP that includes a loss assessment and compensation procedure.	MOTR	MOTR
Construction activities in close vicinity to existing infrastructure such as water supply pipes and other facilities, waste water discharge facilities, electricity lines etc	Damage to infrastructure, supply cuts of infrastructure services.	Measures will be ensured in engineering designing to avoid any disturbance to the existing infrastructure. Prior to construction start the respective service agencies shall be informed about the construction work. Coordinate with respective agencies and provide prior information to the public in case of any required disruption in services during construction	Contractor	Construction Supervision (CS), IPIG/MoTR
Rehabilitation work in villages and around	Noise exceeding the applicable noise standards. Vibrations can damage local	For sensitive receptors such as schools and hospitals applicable noise standards	Contractor	Construction Supervision

MITIGATION MEASURES DURING THE CONSTRUCTION AND OPERATION PERIOD				
Type of activities	**Potential impact**	**Mitigation measures**	**Institutional responsobility**	
			Implementation	**Monitoring**
sensitive recipients, such as schools and hospitals. A list of sensitive receptors is provided in clause 99.	infrastructure, including private property and local (transport) roads.	shall be complied with as far as technically feasible by means of noise measurements and in case of exceedances of standards, ascribe of time restrictions for construction activities between 8.00 am to 19.00 pm. For potential damages to local infrastructure, including private property and local (haulage) roads, compensation procedures will have to be established prior to the beginning of construction and approved by the engineer. In addition, grievance redress procedures shall be put in place to facilitate communication between the contractor and potentially affected people. In addition, haul routes and construction site access roads should be discussed and jointly approved between the contractor and local officials to minimize the risk of conflicts. No vibration during construction of this section of the road.		(CS), IPIG/MoTR
OPERATION PERIOD				
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 Consultant	Construction Supervision (CS)
Increased traffic intensity and high vehicle speeds.	Increased risk of accidents with possible spills of harmful substances.	The action plan in case of a spill of toxic substances. An action plan in emergency situations or emergency response plan is a set of procedures that must be followed to minimize the consequences of emergencies at Project roads, such as spills of oil, fuel or other substances that	MOTR	MOTR

MITIGATION MEASURES DURING THE CONSTRUCTION AND OPERATION PERIOD				
Type of activities	**Potential impact**	**Mitigation measures**	**Institutional responsobility**	
			Implementation	**Monitoring**
		may harm drinking water sources or adversely affect the natural balance of sensitive zones. Additional measures to reduce the risk of accidents and spills-speed control and weighing stations.		
Damage to the drainage system or uncontrolled erosion.	Harmful impact on the environment resulting from damage to the drainage system or uncontrolled erosion.	Routine inspection of drainage and erosion control at least twice a year.	IPIG MoTR	IPIG/MoTR

222. Before commencing construction work, the Contractor shall submit a comprehensive SEMP covering the following aspects:

- Dust control, including the schedule of water spraying on the transport and access roads leading to the construction site, and information about the equipment to be used, places from where water will be poured for dust suppression.
- Asphalt and Crushing Plant Management Plan.
- Plan for the arrangement of the working camp.
- Management of household wastewater, including the provision of toilets and associated sewer systems and wastewater disposal systems to prevent pollution of watercourses.
- Waste management, which provides regular collection and disposal of waste in a hygienic manner, as well as the proposed waste disposal sites for different types of waste (for example, household waste, worn tires, etc.).
- Emergency response plan (response plan in case of fire, oil spill, accident of working equipment, etc.), which must be submitted before the start of construction work.
- Road safety plan for the construction period (this plan must be coordinated with the traffic police). Also, this plan should cover pedestrian safety measures./
- Borrow pits management plan.
- Health and Safety Plan (this plan covers activities aimed at ensuring the health and safety of workers involved in construction work).
- Grievance Redress Mechanism.
- Noise Management Plan
- Old Asphalt Management Plan
- Tree Management Plan
- Environmental Protection Plan for the Bridges Rehabilitation

223. The Contractor must submit CEMP/SEMPs to construction supervision Consultant for approval. The CEMP/SEMPs must be approved by IPIG before start of any on-site civil works/ construction activities.

D. The Environmental Monitoring Plan

224. Environmental monitoring is an important aspect of environmental management during construction and operation stages of the project to safeguard the protection of environment. During construction, environmental monitoring will ensure the protection of embankment from potential soil erosion, borrow pits restoration, quarry activities, location of work sites, material storages, asphalt plants, community relations, and safety provisions. During operation, air, noise, and surface water quality monitoring will be important parameter of the monitoring program.

Table 23 Environmental Monitoring Plan

Environmental issue	What parameter should be monitored	Where should the parameter be controlled	How should the parameter be monitored	When should the parameter be monitored Periodicity	Responsible
Construction Period					
Surface water quality (rivers)	There are no surface watercourse at the project site				
Noise / Vibration Rehabilitation works within settlements where the Project road passes near sensitive recipients such as schools, hospitals, mosques, bazaars and other sensitive socio-economic infrastructure	Prior to construction and during construction activities within identified sensitive hotspots and sensitive receptors close vicinity of sensitive receptors regular control of noise level by portable measure instrument. In case noise standards are exceeded implementation of time restrictions for construction activities	At sensitive receptors within settlements	By means of portable noise / vibration measurement device	During construction period, in areas close to sensitive receptors, on a quarterly basis	CSC, IPIG/MoTR
The deterioration of **air quality**	Dust, SO2, NO2, CO	Within settlements where the Project road comes close to sensitive receptors such as houses, schools, hospitals, mosques, bazars or other sensitive socioeconomic infrastructure. At asphalt plant and at aggregate crusher.	By means of suitable portable measurement device	During construction period, in areas close to sensitive receptors, on a quarterly basis	Construction Supervision Consultant (CSC), IPIG/MoTR with the assistance of the Supervision Consultant (SC)

Environmental issue	What parameter should be monitored	Where should the parameter be controlled	How should the parameter be monitored	When should the parameter be monitored Periodicity	Responsible
Potential tree cutting because tree stem area is subject to embankment filling	Trees located within the newly designed embankment.	At respective tree locations	Inspections; observation. An embankment fill of up to 30 cm at the bottom of the tree stem area can be accepted. A filling up of more than 30 cm will damage the tree and cutting will be necessary. Decision is to be made by the construction supervision engineer. Planting ratio – 1:3	During construction period	Construction Supervision (CN)
Preservation of top soil	Stockpiling and means of protection	Construction site	Inspection, observation	During the preparion of construction site, after stockpiling and after the completion of work on shoulders	Construction Supervision (CN)
Equipment servicing and fuelling	Oil and fuel spill prevention	Contractor's yard	Inspection, observation	Unannounced inspections during construction	Construction Supervision (CN)
Worker 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.	Construction site and work camp	Inspection; interviews; comparisons with the Contractor's method statement	Weekly site visits by a hired health and safety expert. Unannounced inspections during construction and upon receipt of complaints.	Construction Supervision (CN)

Environmental issue	What parameter should be monitored	Where should the parameter be controlled	How should the parameter be monitored	When should the parameter be monitored Periodicity	Responsible
Worker's education on AIDS and STD	Appropriate training	The decision will be made by the designated CSC.	The decision will be made by the designated CSC.	After the commencement of work and at certain intervals throughout the construction period	Construction Supervision (CN)
Material supply Asphalt plant	Possession of official approval or valid operation license	Asphalt plant	Inspection	Before starting work	Construction Supervision (CN)
Borrow-pit areas	Possession of official approval or valid operation license	Sand and gravel reserve of soil and / or borrow-pit	Inspection	Before starting work	Construction Supervision (CN)
Transportation of materials Asphalt	Truck loads covered or wetted Compliance with the Contractor's method statement (limited duration of work; transport routes). Methods of dust suppression.	Construction site / haul routes	Inspection	Unannounced inspections during work	Construction Supervision (CN)
Stone		Construction site / haul routes	Inspection, spot checks	Unannounced inspections during work	Construction Supervision (CN)
Sand and gravel		Construction site / haul routes	Inspection	Unannounced inspections during work	Construction Supervision (CN))
Surface water protection	Contractor's Compliance with Approved Work Design	Bridges and culverts	Inspection	Unannounced inspections during bridge and culvert works	Construction Supervision (CN)
Air pollution due to improper maintenance of equipment Asphalt plant	Exhaust gases, dust	At site	Measurements near the crushers and asphalt batching plants. Regular notes of inspection of vehicles and equipment.	Unexpected inspections during construction works	Construction Supervision (CN) Road Department (RA,PLRA, GD BOR)

Environmental issue	What parameter should be monitored	Where should the parameter be controlled	How should the parameter be monitored	When should the parameter be monitored Periodicity	Responsible
Planting of new trees at the roadside	Regular monitoring and control of successful growth of new planted trees	At locations of new planted trees	Planting of new trees instead of cut down	Monitoring to be conducted in autumn so as to allow for replacement of failures	Contractor-in the 1st year / territorial units of MoTR - in subsequent years
Operation Period					
Increased road kills of domestic animals due to higher traffic loads and vehicle speeds	Road kills of animals	Along 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.)	During a year	Regional divisions of the Road Departments (RA,PLRA, GD BOR)
Increased traffic can increase the potential risks of spills of harmful substances.	Accidents that cause spills of harmful substances	Along new road	Counting of accidents	During a year	MoTR together with Traffic Police of the MIA KR, Ministry of emergency situations of the KR
Damaged drainage system or uncontrolled erosion	Drainage leaks and damage due to erosion	Culvert and drainage facilities	Documention	During a year	Territorial divisions of MoTR
Noise	Noise levels (not to exceed 55dBA daytime and 45dBA nighttime)	At sensitive receptors within settlements	By means of portable noise measurement device	During operation period, in areas close to sensitive receptors, on a quarterly basis	MoTR

RA – Road administration
PLRA – Production Linear Road Administration
GD BOR – General Directorate of the Bishkek-Osh road

Table 24 Preliminary cost estimate for mitigation measures (KGS)

Description	Unit	Quantity	Rate KGS	Amount KGS
Protection of Environment				
Planting, maintenance and watering of trees at the roadside in accordance with the EMP (during the construction phase).	pcs	500	700	350.000
Tree protection during construction works	months	18	15000	270.000
Clearing of construction corridor	t.l.s.			Included in construction work
Removal and storage of topsoil	t.l.s.			Included in construction work
Utilization of solid and household waste of the construction camp	t.l.s			Included in construction work
Possible restoration of working areas and warehousing sites, borrow-pits and soil reserves, roads at the construction site	t.l.s			Included in construction work
Providing an environmental, health and safety manager and training workshops on environmental issues, health and safety	month	18	25.000	450000
Protection of storage areas for materials and equipment maintenance	t.l.s			Included in construction work
Total				**1.070.000**

*t.l.s. – total lump sum

Table 185 Preliminary cost estimate for monitoring measurements (KGS)

Description	Unit	Quantity	Rate KGS	Amount KGS
Monitoring measurements				
Noise monitoring during the construction period	t.l.s.	50	320	16.000
Vibration monitoring during the construction period	t.l.s.	50	420	21.000
Measurements of dust concentration and air pollution level during the construction period	t.l.s.	50	1130	56.500
Water quality monitoring	t.l.s.	00		0
Total				**93.500**

*t.l.s. – total lump sum

Thus, the approximate budget for monitoring by local laboratories for the period of construction (2 years) and the first year of operation of the road is 700,000 KGS in 2018 prices, it should be taken into account that prices may change upwards.

X. CONCLUSIONS AND RECOMENDATIONS

Conclusions

225. Reconstruction of the section of the road e 8.5 - km 15.9 it will improve the condition of the pavement will decrease operating costs for all vehicle owners, helping to make vehicles last longer. Road safety measures will also be improved by providing new traffic signs, safety railings, pedestrian and livestock crossings for the road.

226. Overall the project has significant advantages to the local people and companies operating in the country by providing better/faster access to national and regional markets.

227. At the same time, this project has many work components that can potentially lead to long term, even chronic environmental impacts. These are associated with erosion, tree removal, damage to intersections and roadside access, unaddressed chronic and rising air pollution and noise conditions which are already excessive, inadequate management of large volumes of old asphalt pavement to be removed, inadequate borrow site rehabilitation, and inadequate repair and replacement of the more than 15 culverts and 1 small bridge along the route. The SIEE and its EMP have provided the mitigation measures necessary to avoid many of the construction period impacts, by developing good protocols and work programs for managing potential impacts, and will be implemented.

228. The following impacts, which are discussed in detail in the SIEE and EMP materials, are considered to be the most important and, the extent of which, with proper implementation of the EMP, can be reduced accordingly..

229. During the preconstruction period the eight key tasks to be implemented by MTR, IPIG and CSC will be:

1. Insertion of EMP mitigation and monitoring measures into contract specifications;
2. Preparation of a list of sections where topsoil conservation works will be required when rehabilitating the road;
3. Preparation of a framework program for the management and processing of old asphalt;
4. Earthworks Haul Route framework, defining at least were vehicles cannot go;
5. Construction period access management and restoration steps, as a basis for use by the contractor, working with the traffic police;
6. Inventory of trees, identification of particularly valuable species and preparation of a plan for protection (where possible), cutting, and planting of new seedlings;
7. Verification with the design team of the inclusion in the project of the following facilities/public safety measures and services, such as:
   - Pedestrian crossings and traffic lights,
   - Lighting signage and sidewalks,
   -Bus stops, .

During the construction period the CSC and the Contractor(s) will need to:

1. Undertake Air Quality and noise quality field-testing for the full two years and one operating year.
2. The Contractor – to manage all petroleum products and prevent spills, ensure proper waste disposal.
3. The Contractor – to manage sewage and garbage at work sites at all time.
4. To provide basic occupational health and safety items at work sites, including first aid, water, shade and proper gear including hats, shoes and face masks.
5. Maximize the reuse or redistribution of the old asphalt.
6. Undertake the tree planting and maintenance task as each construction area is vacated; i.e. do not wait until the end of the construction period.
7. Implement dust suppression program on all haul roads and at construction sites.
8. Understand and implement all regulations standards and obtain licenses for all borrow site operations and rehabilitation.
9. Enforce occupational health and safety requirements as prescribed by law.
10. Inspect all culverts to be sure the re-installation does not lead to chronic downstream scour, and that any diversion and debris have been cleared.

During year 1 of the operating period the CSC and Contractor with the assistance of the RMU, will:

11. Prepare a photo record of all culverts, confirming proper placement, downstream drainage and debris removal.
12. Continue the air quality and noise monitoring for the year.
13. Examine noise-modelling data collected and prepare a plan of measures to reduce noise exposure, such as the arrangement of berms and fences in vulnerable areas
14. Inspect decommissioned borrow areas to confirm rehabilitation and proper closure.
15. Inspect the condition of pedestrian crossings and crossings for animal livestock for the purpose of their repair/improvement if that is required
16. At the end of each period, the EMP determines the preparation of progress reports that will be used to monitor compliance and plan for the next phase

Recommendations

1. The EMP will be closely followed, and the reporting required on it will be timely submitted. MoTR recommends that noise suppression measures should be carried out taking into account the analysis of noise measurements during construction and the first year of operation.
2. The care and watering function of the trees should be transferred to the local communities or RMU until the trees reach the age of 8 years or more and will no longer need careful care.
3. The CSC and the IPIG will conduct training for all involved project participants and will focus on providing reliable consultations to the contractor, especially on the preparation and implementation of environmental work plans during construction.
4. Immediately after the start of the operational period, the CSC and the Contractor will verify compliance with environmental protection measures in order to ensure that all measures required from the contractor are implemented.
5. . Based on the results of the noise modeling: (i) Porous asphalt; pores >15% 0/11. The nose is applied the operational noise levels will drop; (ii) reducing the speed limit from 60 km / h to 50 km / h, it will prevent the increase in noise from vehicles.

6. Based on the results of the vibration modeling - to carry out construction work without using vibration. The number of passages of the rollers will be increased to achieve the quality of compaction
7. The IEE is a "living document" and will be updated as necessary to meet all environmental requirements.

ANNEX 1

Minutes of the Public Consultation Meeting
under the CAREC Corridor 3 (Bishkek-Osh Road) Improvement Project, Phase 4
Road Sections: Bishkek-Kara-Balta and Madiniyat – Djalal-Abad

Date: June 10, 2013

Place of meeting: Voenno-Antonovka village, Sokulukskiy rayon, Chuiskaya oblast, Conference-hall of Voenno-Antonovka ayil okmotu

Meeting started: 9.00

Meeting ended: 10.20

Presented:

IPIG/MOTR

Asylbek Abdygulov	Safeguard Specialist

CONSULTANT «KOCKS CONSULT GMBH»

Vasiliy Chernyh	Deputy Team Leader
Nurul Hoque	Sociologist
Erik Shukurov	Ecologist

Local community

Agenda: Presentation on Bishkek-Osh Road Rehabilitation Project, Section Bishkek-Kara-Balta

V. Chernyh made a presentation on Bishkek-Osh Road Rehabilitation Project, road section Bishkek-Kara-Balta to the local community (residents of Voenno-Antonovka village). The presentation covered the following issues: 1) who is going to finance the project implementation, 2) who will implement the project, 3) ADB policy, 4) economical and social benefits of the project 5) environmental impacts' mitigation measures. Also, people were explained about the *Grievance Redress Mechanism* to be applied towards APs and others having any relation to the project implementation.

Upon completion of the presentation made by V. Chernyh, local residents asked a few questions. The focus was on how road safety measures would be implemented?.

Question: Will be a bend provided to a knitting factory "VOSST"?

V. Chernyh explained on furnishing of all junctions with gaps in a median strip with road marking, installation of traffic lights.

Question: What will happen to the trade outlets occurred within the project implementation zone?

V. Chernyh explained that all kiosks built in a light construction will be temporary shifted from the construction side and returned back upon completion of the project. Capital structures most likely will be removed.

Question: How will the issue on cut plantations be solved?

Asylbek: First the owners of the trees to be cut will be identified. Upon implementation of the project all cut trees will be rehabilitated as 10:1. The contractor will be responsible for plantation and watering the trees during a year upon completion of construction works with following handing them over to RMD or local authority.

Question: What is the width of the designed road? What about the communication lines?

V. Chernyh. Designed width of the roadway including shoulders is up to 29 meters. Total width within the Right of Way is 50 meters. During the road construction works the culverts which are in bad conditions will be replaced. After replacement, the old ones will be handed over to local authorities.

Question: What about the traffic lights, street lighting? Will they be provided? What will be the structure of the road pavement?

V. Chernyh. Traffic lights, street lighting are foreseen by the project. Also the project includes construction of sidewalks, channels and drainage ditches. Besides it is planned to pave with asphalt the junctions 30-50 meters long as well as access roads to the gates of households. The sidewalks will be equipped with ramps. The profile of the road will be raised; there will be reinforced concrete chutes on the shoulders as well as all required engineering measures will be taken to improve the safety of the roadway. All road construction works will be carried out in accordance with all established standards, the construction supervision consultant will monitor the whole construction process. The service life of the road is 18 years.

Then Abdygulov Assylbek explained that there would be the *Grievance Redress Mechanism* to be implemented within the frameworks of the Project. This mechanism would facilitate and speed up the feedback with the public. He also informed on measures to be taken to reduce the environmental impacts.

At the end of the meeting V. Chernyh thanked the participants for taking part in the public consultation meeting and expressed hope for successful cooperation in the course of the project implementation.

ANNEX 2

Noise Modelling Report

Hagler Bailly Pakistan

Central Asia Regional Economic Cooperation Corridor 3

Noise Modeling of 7.4 km Section of the Bishkek-Kara Balta Section of the Bishkek-Osh Road Baseline Construction and Operating Period

Hagler Bailly Report

D8I06BOR
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Acronyms

BH	Brick House
EIA	Environmental Impact Assessment
HUC	House Under Construction
IEE	Initial Environmental Examination
IFC	International Finance Corporation
KR	Kyrgyz Republic
ND	Non-dwelling
SND	Steel Non-dwelling
ToR	Terms of Reference

Units

dBA	A-weighted decibels
km	kilometer
km/h	kilometer per hour
Leq	Equivalent Sound Level
Lmax	Maximum Sound Level
m	Meter
m^2	square meter

1. Executive Summary

1. The Bishkek-Osh Road, on the Central Asia Regional Economic Corridor 3, represents about 1/4th of the core international road corridor network in the Kyrgyz Republic (KR). The starting section of Bishkek-Kara Balta Section (the "Project" or "Project road") of the Bishkek-Osh Road is 7.4 kilometer (km) long. It starts at KM8.5 and ends at KM15.9 (**Figure 1.1**).

2. EPTISA Servicios De Ingenieria S.L./Eptisa Muhendislik/RAM Engineering (the "Client") acquired the services of Hagler Bailly Pakistan (Pvt.) Limited (HBP) to carry out noise modeling of the construction and operation of the Bishkek-Kara Balta Section.

3. The scope of this study includes the noise modeling of all front row dwellings along the 7.4 km (KM8.5 to KM15.9) long stretch of the Bishkek-Kara Balta Section of the Bishkek-Osh Road.

1.1 Noise Evaluation Criteria

4. From the Kyrgyz Noise Standards, as discussed in **Section 2.2**, the applicable standard for the purpose of this report is for "Areas immediately adjacent to dwellings, polyclinics, dispensaries, rest homes, holiday hotels, libraries, schools, etc." which is the same as that for the IFC category for "Residential; institutional; educational" areas (that is daytime: 55 dBA and nighttime: 45 dBA). The report, EIA of CAREC Transport Corridor 1 (Bishkek–Torugart Road) Project 3[1] also recognizes that Kyrgyz noise standards are consistent with that of the multilateral banks.

5. The existing or without-Project noise levels (see **Section 4**, *Baseline Noise Levels*) exceed the applicable standards, both Kyrgyz and IFC limits (55 dBA daytime and 45 dBA nighttime). The alternate IFC guideline (see Point 1 in **Table 2.2** in **Section 2.2**) states that *noise impacts should result in a maximum increase in background levels of 3 dBA at the nearest receptor location off-site.*

6. The criterion of a maximum of 3 dBA increase is used in this report to discuss compliance and magnitude of noise impacts. For every doubling of acoustical energy, there is a 3 dBA increase in noise levels. A 3 dBA increase in sound level is barely noticeable to the human ear. An increase in sound level of the order of 5 dBA is when most listeners report a noticeable or significant change in noise level. Furthermore, it takes a 10 dBA increase before the average listener *hears "*double the sound".[2] Therefore, a limit of a 3 dBA increase over baseline noise level is considered as a reasonable and acceptable limit for the purpose of this report.

7. Lastly, it is not in the scope of HBP's Terms of Reference (ToR) to interpret the applicable noise criteria. However, consistent with the ToRs this report provides all the information and results.

8. Required for taking an informed decision by the designers and regulators. It is understood that MOTR will undertake this task with guidance from EPTISA as needed.

[1] https://www.adb.org/sites/default/files/project-document/62464/42399-02-kgz-eia-draft-01.pdf

[2] https://www.abdengineering.com/blog/perception-vs-reality/ Accessed Dec 21,2017

Figure 1.1: Project Location

1.2 Baseline Noise Levels

9. The baseline noise levels already exceed the Kyrgyz and IFC day and nighttime limit by an average of 14 dBA and 18 dBA, respectively. For compliance purposes, it would be appropriate to use IFC guideline of baseline + 3 dBA.

10. The simulated noise levels for the present road conditions, traffic, and vehicle speeds can be considered as the baseline noise levels for comparison with future scenarios and for assessing the incremental impact during construction and operation phases.

1.3 Project Impacts

11. Noise impacts during construction and operation of the Project road are modeled to check the compliance with the IFC guideline of baseline + 3 dBA. The predicted noise levels in 2018, 2019 and 2020 (construction period) without construction work are presented in **Table 5.7** in **Section 5.3**. These noise levels are only due to projected traffic in 2018, 2019 and 2020 with baseline road conditions. **Table 5.7** in **Section 5.3** also shows the increment over baseline noise levels**.** On average, there is an increase of 0.2 dBA, 0.5 dBA and 0.7 dBA from baseline (2017) in 2018, 2019 and 2020, respectively.

1.3.1 Construction Noise Impacts

12. Given the complexity of capturing construction operations, as there are many different combinations of equipment working at one time and emitting different sounds. Four deployment scenarios and two configurations (set of equipment working at the same time) were defined (see **Table 1.1**) and form the basis of the modeling of construction noise impacts.

Table 1.1: Construction Equipment Deployment Groupings for Extreme and Typical Configurations

Equipment	Stage A. Preparation	Stage B. Asphalt Breaking	Stage C. Sub-base and Base	Stage D. Asphalt Laying
Extreme Configuration				
Backhoe	2	4		
Concrete Mixer Truck				2
Dump Truck	4	2	4	
Front End Loader	2	2		
Grader			2	
Paver				2
Roller			1	2
Water Sprayer			1	2
Typical Configuration				
Backhoe	1	2		
Concrete Mixer Truck				1
Dump Truck	2	1	1	
Front End Loader	1	1		

Equipment	Stage A. Preparation	Stage B. Asphalt Breaking	Stage C. Sub-base and Base	Stage D. Asphalt Laying
Grader			1	
Paver				1
Roller			1	1
Water Sprayer			1	1

13. **Table 1.2** shows an average increase over the baseline in respective stages of construction during day and nighttime with Typical Configuration. It can be seen that daytime noise levels only exceed the IFC guideline of baseline + 3 dBA in stage C only by 1 dBA, respectively during the construction period. The nighttime noise levels exceed in all stages. During nighttime the levels exceed by an average of 1.3 dBA, 2.1 dBA, 5.0 dBA and 1.5 dBA in stages A, B, C and D, respectively.

Table 1.2: Increment over Baseline during Typical Configuration (dBA)

Year	Stage A		Stage B		Stage C		Stage D	
	Day	Night	Day	Night	Day	Night	Day	Night
2018	1.6	4.2	2.0	5.0	3.7	7.9	1.8	4.4
2019	1.7	4.3	2.2	5.1	3.8	8.0	1.9	4.5
2020	2.0	4.5	2.4	5.2	3.9	8.1	2.0	4.6

14. **Table 1.3** shows an average increase over the baseline in respective stages of construction during day and nighttime with Extreme Configuration. The day and nighttime noise levels exceed in all stages. During daytime the levels exceed by an average of 0.4 dBA, 1.3 dBA, 3.9 dBA and 0.7 dBA in stages A, B, C and D, respectively. During nighttime the levels exceed by an average of 4.4 dBA, 5.7 dBA, 8.9 dBA and 4.9 dBA in stages A, B, C and D, respectively.

Table 1.3: Increment over Baseline during Extreme Configuration (dBA)

Year	Stage A		Stage B		Stage C		Stage D	
	Day	Night	Day	Night	Day	Night	Day	Night
2018	3.3	7.3	4.2	8.7	6.9	11.9	3.6	7.9
2019	3.4	7.4	4.3	8.7	6.9	11.9	3.7	7.9
2020	3.5	7.5	4.4	8.8	7.0	12.0	3.8	8.0

1.3.2 Operation Noise Impacts

15. The modeling study provided projections of noise for 2025, 2030 and 2035, assumed a continuing natural growth of about 7% per year for passenger cars and 4% per year for trucks, with the same general composition. Estimated future traffic volume projections for years 5, 10 and 15 after the operation of the road are presented in **Table 4.3, Table 5.4** and **Table 6.1** of the report.

16. The operational noise levels in 2025, 2030 and 2035 at selected receivers follow IFC guideline of baseline + 3 dBA.

17. As the baseline is already in exceedance to the Kyrgyz and IFC limit of 55 dBA and 45 dBA during day and night, respectively the alternative is to check compliance to the IFC guideline baseline level of + 3 dBA. The noise contours are presented for the year 15 (2035) and checked its compliance with IFC guideline. The contours show compliance to the IFC guideline of baseline + 3 dBA.

1.4 Suggested Mitigative Measures and Monitoring Actions

18. The design of abatement measures shall start with setting of the target noise levels. The target levels could be the IFC or KR absolute noise limits, or the baseline + 3 dBA. The recommended route is to use the IFC guideline of baseline + 3 dBA and use these values as the threshold for the application of mitigative measures.

1.4.1 Construction Period

19. The suggested measures that needs to be considered are as follows:

- **Construction Planning**. Many noise issues can be avoided by planning the construction activities in a manner that minimizes the disturbance to the community.
- **Noise Control at Source**. Taking measures to prevent emission of potentially offensive noise, or source control, is, in general, the most effective form of noise mitigation.[3]
- **Equipment Operation Training**. According to US FHWA, careless or improper operation or inappropriate use of equipment can increase noise levels. Poor loading and unloading, excavation, and hauling techniques are examples of how lack of adequate guidance and training may lead to increased noise levels.
- **Temporary Noise Barriers**. Install temporary noise barriers where other mitigations are unable to reduce noise to desired levels.
- **Night Construction**. Any type of construction activity during the night will not be allowed.
- **Distance Attenuation**: As construction equipment is considered as the point source and the standard reduction for point source noise is 6 dBA per doubling of distance from the source.

1.4.2 Operating Period

20. Two mitigation options were considered as per Client instruction to avoid any worst situation in 2035. These include:

- **Pavement Modification**: Noise is directly related to the aggregate size used in the asphalt formulation. Smaller the aggregate size larger will be the reduction. Pavement options are as follows:
  - PM1: Asphalt concrete 0/11 without gritting (void % 7-8%)
  - PM2: Porous asphalt; pores >15% 0/11

[3] Federal Highway Authority. *Construction Noise Handbook*.

- **Speed Reduction:** Noise is directly related to the speed of the vehicle. The lower the speed the lower the noise level. Speed options are as follows:
  - SR1: KM8.5-KM15.9 – 55 km/h
  - SR2: KM8.5-KM15.9 – 50 km/h

1.5 Recommendations

21. Construction should be avoided during nighttime as the nighttime noise levels during on-going construction work exceed the IFC guideline of baseline + 3 dBA by 5.0 dBA and 8.9 dBA, during Typical and Extreme Configurations, respectively. If it is inevitable then “Typical Configuration” should be the prevailing configuration with the suggested mitigation measures in-place.

22. PM1 surface (Asphalt concrete 0/11 without gritting - void % 7-8%) should be applied as the predicted noise levels in 2035 with the proposed pavement (asphalt concrete) are very close to IFC guideline of baseline + 3 dBA. This limit will be exceeded with an increase in vehicle speed from 60 km/h to 70 km/h.

23. Shifting to low-noise pavement is the preferred option as compared to reduction of vehicle speeds as drivers may over speed even after application of speed limits resulting in noise levels exceeding the standards.

2. Introduction

24. The Bishkek-Osh Road, on the Central Asia Regional Economic Corridor 3, represents about 1/4th of the core international road corridor network in the Kyrgyz Republic (KR). The starting section of Bishkek-Kara Balta Section (the "Project" or "Project road") of the Bishkek-Osh Road is 7.4 kilometer (km) long. It starts at KM8.5 and ends at KM15.9 (**Figure 2.1**).

25. EPTISA Servicios De Ingenieria S.L./Eptisa Muhendislik/RAM Engineering (the "Client") acquired the services of Hagler Bailly Pakistan (Pvt.) Limited (HBP) to carry out noise modeling of the construction and operation of the Bishkek-Kara Balta Section.

26. The scope of this study includes the noise modeling of all front row dwellings along the 7.4 km (KM8.5 to KM15.9) long stretch of the Bishkek-Kara Balta Section of the Bishkek-Osh Road.

2.1 Key Terminology

27. The terminology used in this report is explained below for the convenience of the reader.

- **Receptor:** Buildings near the road that are likely to be sensitive to noise coming from the road construction and operation.
- **Receiver:** The virtual points at which the noise levels are calculated. These are placed on the building façade on the side facing the noise source (Project road). In case of multistory buildings, receivers are placed at each floor.
- **Chainage:** The distance of any point on the road, measured in kilometer, from Bishkek. It is written as "KM" for kilometer followed by the distance correct to one place of decimal. Thus, the section of the road for which noise model is developed starts at *KM8.5* and ends at *KM15.9*.
- **Decibel (dB):** A unit used for expressing the ratio of two quantities in logarithmic scale. In sound literature, both sound pressure level and sound power levels are expressed in this unit. The unit bel (named after Alexander Graham Bell) is a very large measurement so the loudness scale is shown in decibels (dB)—one-tenth of a bell.
- **A-weighted decibel (dBA):** The measure of the overall level of sound across the audible spectrum with a frequency weighting (the "A-weighting") to compensate for the varying sensitivity of the human ear to sound at different frequencies.
- **Equivalent Continuous Sound Level (Leq):** A notional steady sound level, which would, over a given period, deliver the same sound energy as the actual time-varying sound over the same period. Hence fluctuating levels can be described in terms of a single figure level. It can be considered as the "average" sound level where the average is taken over the fluctuating energy.

Figure 2.1: Bishkek-Kara Balta Section of the Bishkek-Osh Road

- **Sound Power Level (SWL):** The acoustic energy emitted by a source expressed relative to a standard reference level. By convention, the reference level is 1 picowatt (10^{-12} watt). For example, the acoustic energy emitted by a rock music loudspeaker is 100 W (100 Joules per second). In dBA this will be 140 dBA ($10\times\log_{10}(100/10^{-12})$). Note that SWL depends on the inherent characteristics of the sound source and hence is fixed unless the source properties are changed.
- **Sound Pressure Level (SPL):** The pressure caused by a sound wave passing through a surface or a medium expressed relative to a standard reference level. By convention the reference level is 20 micropascal (20 µPa or 20×10^{-6} Pa). For example, the sound pressure caused by a rifle, one meter from the source is 200 Pa. In dBA this will be 140 dBA ($20\times\log_{10}(200/(20\times10^{-6}))$). Note that SPL depends on the distance from the source at which it is measured. Sound pressure is ultimately, what the ear hears.

2.2 Noise Evaluation Criteria

28. **Table 2.1** provides the summary of Kyrgyz Republic (KR) noise standards whereas **Table 2.2** provides the noise guidelines of the International Finance Corporation (IFC). Both Kyrgyz and IFC standards do not distinguish between new or rehabilitation work and use these standards across the board.

Table 2.1: Kyrgyz Noise Standards

Description of Activity/Category	Leq (dBA)	Lmax (dBA)
Areas immediately adjacent to hospitals and sanatoriums	Day = 45 Night = 35	Day = 60 Night = 50
Areas immediately adjacent to dwellings, polyclinics, dispensaries, rest homes, holiday hotels, libraries, schools, etc.	Day = 55 Night = 45	Day = 70 Night = 60
Areas immediately adjacent to hotels and dormitories	Day = 60 Night = 50	Day = 75 Night = 65
Recreational areas in hospitals and sanatoriums	35	50
Rest areas at the territories of micro-districts and building estates, rest houses, sanatoriums, schools, homes for the aged, etc.	45	60

Source: Kyrgyz National standards, as provided by IPIG and EPTISA. November. 2017

Table 2.2: IFC Noise Level Guidelines

Receptor	Noise Level Guideline (dBA)	
	Daytime (07:00 - 22:00)	**Nighttime (22:00 - 07:00)**
Residential; institutional; educational*	55	45
Industrial; commercial	70	70

Notes (Extracted from IFC Guidelines):

1. Noise impacts should not exceed the levels presented in the table, or result in a maximum increase in background levels of 3 dBA at the nearest receptor location off-site
2. Guidelines values are for noise levels measured out of doors.
3. Noise monitoring may be carried out for the purposes of establishing the existing ambient noise levels in the area of the proposed or existing facility.
4. Typical monitoring periods should be sufficient for statistical analysis and may last 48 hours with the use of noise monitors that should be capable of logging data continuously over this time period, or hourly, or more frequently, as appropriate.
5. Monitors should be located approximately 1.5 m above the ground and no closer than 3 m to any reflecting surface (e.g., wall).

Source: International Finance Corporation, General Environmental, Health, and Safety (EHS) Guidelines, Environmental Noise Management. April 2007.

29. Kyrgyz Noise Standards, as given in **Table 2.2** the applicable standard for the purpose of this report is for "Areas immediately adjacent to dwellings, polyclinics, dispensaries, rest homes, holiday hotels, libraries, schools, etc." which is the same as that for the IFC category for "Residential; institutional; educational" areas (that is daytime: 55 dBA and nighttime: 45 dBA). The report, EIA of CAREC Transport Corridor 1 (Bishkek–Torugart Road) Project 3[4] also recognizes that Kyrgyz noise standards are consistent with that of the multilateral banks.

30. The existing or without-Project simulated noise levels (see **Section 4**, *Baseline Noise Levels*) exceed the applicable standards, both Kyrgyz and IFC limits (55 dBA daytime and 45 dBA nighttime). The alternate IFC guideline (see Point 1 in **Table 2.2**) states that *noise impacts should result in a maximum increase in background levels of 3 dBA at the nearest receptor location off-site.*

31. The criterion of a maximum of 3 dBA increase is used in this report to discuss compliance and magnitude of noise impacts. For every doubling of acoustical energy, there is a 3 dBA increase in noise levels. A 3 dBA increase in sound level is barely noticeable to the human ear. An increase in sound level of the order of 5 dBA is when most listeners report a noticeable or significant change in noise level. Furthermore, it takes a 10 dBA increase before the average listener *hears "*double the sound".[5] Therefore, a limit of a 3 dBA increase over baseline noise level is considered as a reasonable and acceptable limit for the purpose of this report.

32. Lastly, it is not in the scope of HBP's ToR to interpret the applicable noise criteria. However, consistent with the ToRs this report provides all the information and results required for taking an informed decision by the designers and regulators. It is understood that MOTR will undertake this task with guidance from EPTISA as needed.

[4] https://www.adb.org/sites/default/files/project-document/62464/42399-02-kgz-eia-draft-01.pdf

[5] https://www.abdengineering.com/blog/perception-vs-reality/ Accessed Dec 21,2017

2.3 Scope of the Study

33. Consistent with the ToRs, the scope of this study focuses on the front row dwellings along the road corridor starting from KM8.5 to KM15.9. The analysis to be undertaken include:

- Estimation of simulated noise baseline
- Estimation of construction noise levels
- Estimation of operational noise levels
- Preparation of conclusions
- Preparation of executive summary

2.4 Modeling Approach

34. The road was first modeled using existing road conditions (**Section 4**, *Baseline Noise Levels*) and traffic counts conducted in April 2017. This is referred to as the "baseline."

35. The existing road has a degraded surface and due to increase in traffic volume over the years, it does not have sufficient carrying capacity. The number of lanes and width of the lanes is also not uniform. The proposed Project will be a major upgrade of the existing road and will include widening of the road, making the width of the road uniform, and laying a new base and road surface. The road has sufficient Right of Way (RoW) available and all construction will be undertaken within the existing RoW. However, some structures and trees falling within the design width will be removed.

36. The construction period noise levels were also modeled. Construction is likely to be carried out throughout 2018, 2019 and most likely 2020.[6] The construction phase noise for 2018 includes noise due to projected traffic levels in 2018 (estimated using the 2017 traffic and growth rate provided by the Client). The same approach was used for 2019 and 2020 (**Section 5**, *Construction Noise Levels*). The US Federal Highway Administration (FHWA) construction noise model[7] was used for basic construction equipment noise data.

37. It is assumed that the road will come into operation by 2021. The operation phase noise modeling for the Year 5, Year 10 and Year 15 was thus carried out for 2025, 2030 and 2035, respectively (**Section 6**, *Operational Noise Levels)*. The traffic volume was estimated using the 2017 traffic and growth rate provided by the Client. The compliance is checked for the year 15 (2035).

38. The outputs provided are as follows:

- Baseline (single point receiver noise table and maps and day and nighttime noise contours)

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[6] The planned construction period is 2017, 2018 and 2019. This is assuming that construction will not take place in winters and considering the pace of the work in 2017 the removal of the old asphalt on one half of the road will take a full season. A one-year extension in construction period is therefore expected (2020). One way to avoid extension of construction period by a year would be to increase the construction duration from 10 hours to 16, 20, or 24 hours. For this, it is recommended that the equipment is deployed during nighttime as well. Another option would be to increase the number of equipment deployed during summer to maintain the schedule of construction.

[7] Roadway Construction Noise Model

- Construction phase (single point receiver noise table)
- Operation phase after 5 years (single point receiver noise table)
- Operation phase after 10 years (single point receiver noise table)
- Operation phase after 15 years (single point receiver noise table, day and nighttime noise contours and compliance status maps)

2.5 Objectives of the Report

39. This report aims to provide:

- specific details of the noise model used for this study;
- fixed model parameters and assumptions made on the variables;
- simulated noise baseline from current traffic and road conditions;
- simulated construction noise levels;
- simulated operational noise levels for the three operating periods namely, year 5, 10 and 15; and
- mitigation options; low noise pavements and lower speeds.

3. Model Setup

3.1 The Model

40. The noise model, SoundPLAN Version 8.0 by Braunstein + Berndt GmbH/ SoundPLAN International LLC was used for modeling of noise in construction and operation phases. The model is capable of modeling noise levels in three-dimensions. In addition, the Road Construction Noise Model (RCNM) Version 1.1,[8] of the FHWA of the United States was also used for modeling of noise in construction phase.

3.2 Model Inputs

41. Model inputs comprise of the modeling environment parameters — inputs that are fixed in the beginning and remain unchanged in various model runs, and the modeling scenario parameters — inputs that may change in various model runs. The modeling environment parameters or fixed parameters of the model include the digital ground model (DGM) of the natural terrain, the road elevation, the buildings, the noise calculation scheme, the time slices for calculating Leq and the environment factors (air temperature in ^{0} C, humidity in % and air pressure in mbar). Tree cover is also a fixed parameter but was not taken into account in modeling due to its negligible effect on noise attenuation. The variable parameters of the model include the road surface, the road emission line, the traffic volume and the vehicle speed. **Table 3.1** provides the list and description of fixed modeling environment parameters.

Table 3.1: Fixed Parameters of the Model

Parameter	Description
Digital ground model (DGM)	A DGM is the basis for creating a 3D noise model. SoundPLAN uses DGM to set a ground for all the additional objects entered or imported in the model. The model works with UTM coordinate system (that is in meters), so the imported data must be in this unit. To develop the DGM, the AutoCAD drawing provided by the Client was geo-referenced in ArcGIS using the control points (longitude and latitude in WGS 84 datum) provided by the Client. This was required since the AutoCAD drawing was in local coordinate system. Once geo-referenced, the data was exported as DXF in the X, Y, Z format, where X and Y are the coordinates in UTM and Z is the elevation in meters. This file was then imported to SoundPLAN as DGM input file. All subsequent objects that were then entered or imported into the model were automatically placed using the elevation of the DGM made by SoundPLAN.
Road elevation	Road elevation was defined by the elevation of the road centerline. The road centerline was provided by the Client in the AutoCAD drawing from where it was imported to SoundPLAN as described above.
Receiver	As there are thousands of structures along the road and it would be very time consuming to assign receiver to each structure so the structures with more than one floor and with occupants (dwellings) were selected for the receiver noise levels. All the structures that are even more than one floor but are non-dwellings are not taken as receivers. In addition to these, receivers were placed at distances 10, 15, 20, 25, 30, 35, 40 and 50 m from the road edge. The receivers were placed at the front side of the structure facing the road. **Table 3.2** and **Figure 3.1** provides the details and location of selected

[8] https://www.fhwa.dot.gov/environment/noise/construction_noise/rcnm/

Parameter	Description
	receivers.
Noise protection wall	All the boundary walls are considered as noise protection walls with an average height of 1.8 m as provided by the Client.
Structure/building	All the front row digitized structures were provided by the Client which were first geo-referenced and then imported to the model as DXF file. The structures are as follows: • Brick house (BH) • Non-dwelling (ND) • Steel non-dwelling (SND) • House under construction (HUC) • Canopy (street insulated structure with roof and walls) The height of each structure was taken from the number of floors provided by the Client in the digitized file whereas the height of one floor was taken as 3.0 m.
Noise calculation scheme	The noise pressure level from moving sources depends on many factors. There are many schemes available to calculate the noise levels at the receivers. SoundPLAN incorporates noise calculation schemes of various countries such as Germany, Russia, USA, and Japan. Where required by local regulations, it is mandatory to use the calculation standard prescribed by the national regulatory agency. In other countries, any one of the robust schemes may be used. It may be noted that all these schemes use slightly different methods for calculations but produce similar results. For this model, the Russian scheme could not be used as it allows for limited types of road surfaces. Particularly, the option of *asphalt concrete* type desired for the proposed road Project is not available. The German scheme was used which can model asphalt concrete pavement. It may be noted that, in a previous work in Georgia by HBP,[9] the noise levels were measured and corresponding traffic counted and simulated using the German scheme. The measured and simulated results were compared and found to be very similar. This indicates the noise levels calculated by the German scheme are suitable for use in the region.
Time slices	Two-time slices (Day: 7:00 am to 10:00 pm, Night: 10:00 pm to 7:00 am) were used, the same as defined in the International Finance Corporation (IFC) noise guidelines.
Environment factors (annually)[10]	Air temperature – 12 ^{0}C Air pressure – 1018 mbar Humidity – 60% Wind speed – 1.95 m/s
Traffic zones	Project road falls within Traffic Zone from Bishkek (KM9.0) to Sadove (KM35.0)

[9] Hagler Bailly Pakistan (2016), Environmental Impact Assessment of Batumi Bypass Project for the Ministry of Regional Development and Infrastructure of Georgia, Roads Department and the Asian Development Bank.

[10] Environment factors were considered on annual basis as the yearly average of these factors was similar to the April average in which the noise measurements were taken. https://www.timeanddate.com/weather/kyrgyzstan/bishkek/climate

Table 3.2: Details of Selected Receivers

No.	Chainage (KM)	X	Y	Building ID	Distance from Road (m)
R1	9.98	458398.10	4747050.51	2BH	10
R2	9.56	458818.97	4747068.22	2BH	15
R3	9.44	458943.44	4747067.04	2BH	20
R4	12.30	456099.53	4746906.25	2BH	25
R5	11.42	454147.65	4746864.38	2HUC	30
R6	12.16	456235.10	4746997.59	2BH	35
R7	13.86	454534.69	4746797.07	2BH	40
R8	13.34	455056.63	4746819.26	2BH	50
R9	10.84	457541.52	4746989.13	3HUC	30
R10	11.62	456770.13	4746938.43	3HUC	35
R11	10.70	457690.84	4747015.46	3BH	15

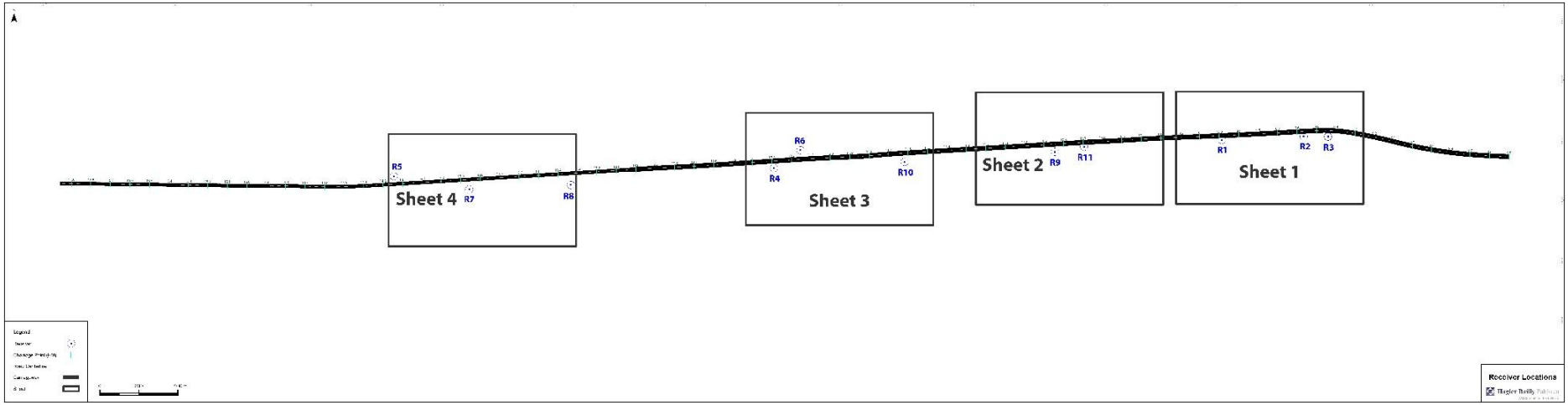


Figure 3.1: Location of Selected Receivers

4. Baseline Noise Levels

42. The application of noise criteria (**Section 2.2**) requires knowledge of baseline noise levels at the point of assessment. The baseline noise levels can be estimated by simulating the noise from the existing traffic. For this purpose, 2017 has been defined as the baseline year.

4.1 Inputs – Variable Parameters

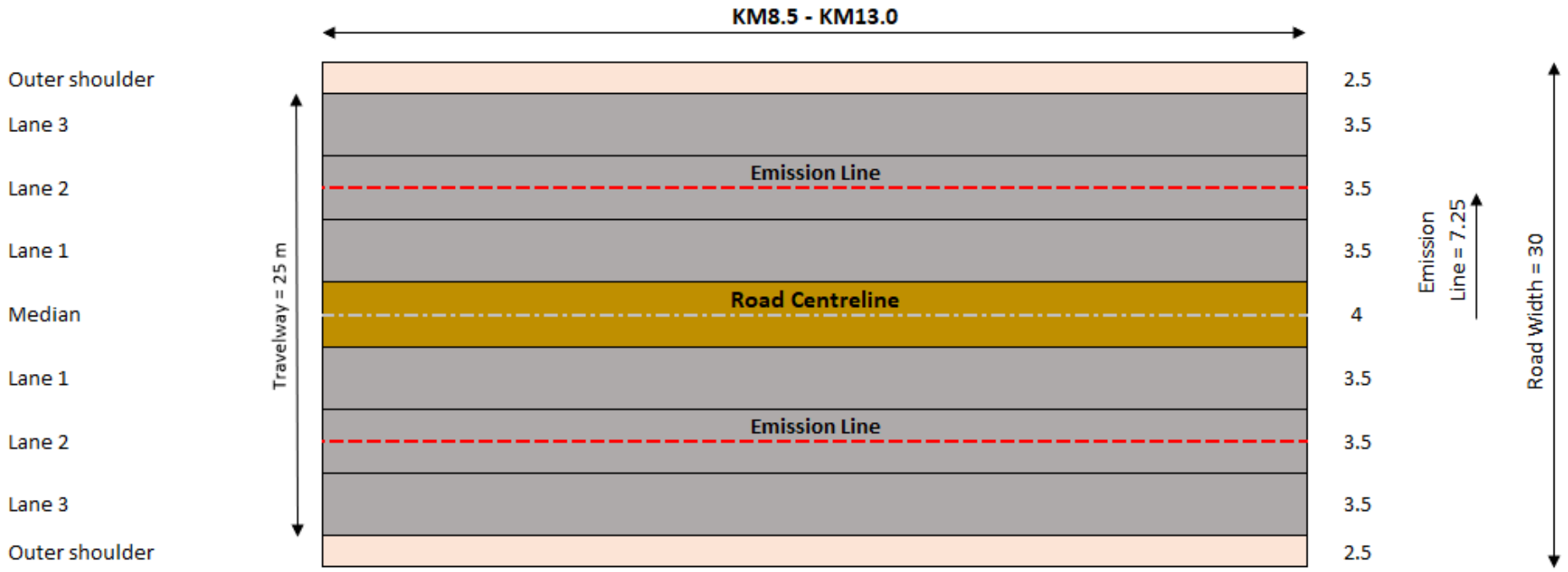
43. **Table 4.1** provides the list and description of the variable parameters of the model used for noise simulations.

Table 4.1: Variable Parameters of the Model

Parameter	Description
Road width and emission line	The widths for existing road are taken from the file named "Explanatory note FINAL EN –Table 3.1.3. Existing and projected width of road section Bishkek – Kara-Balta at Page No. 23." Traffic noise was assumed to come from a line located at the center of the carriageway. This line, the *emission line*, was defined with respect to the road centerline. For dual carriage highway, there will be two emission lines, one in each direction. In the SoundPLAN, the distance of the emission line from the road centerline was entered. The distance from the centerline depends on the width of the median, number of lanes and the width of each lane as follows: Emission Line (m) = $(W_L \times N_L + 2\,W_{IS} + W_M)/2$ Where: W_L = Width of each lane N_L = Number of lanes on each carriageway W_{IS} = Width of inner shoulder W_M = Width of median **Table 4.2** provides the widths of carriageway and distances of emission lines for the existing road. **Figure 4.1** shows an example of the calculation of emission lines.
Traffic volume	Traffic volume was taken from the report on Traffic Growth Analysis as shared by the Client. The report provides the breakdown for 2017 from which the per hour traffic during daytime and nighttime was calculated. Per hour traffic was calculated as sum of cars during daytime hours divided by the number of day hours. Same was done for the nighttime traffic. **Table 4.3** provide the calculation of traffic volume used in modeling.
Vehicle speed	The speed for all modes of vehicle is taken as 60 km/h.
Pavement	Asphalt concrete with considerable roughness that adds 2 dBA to the noise levels due to poor condition of the road.

Table 4.2: Road Widths

Road Section	No. of Lanes	Each Lane Width (m)	Dividing Strip (m)	Road Width (m)	Distance of Emission Line (from road centerline) (m)
KM8.5-KM13.0	6	3.50	4.0	25.0	7.25
KM13.0-KM15.9	4	3.75	4.0	19.0	5.75



Number of lanes on each side	NL	3	
Width of each lane	WL	3.5	
Width of median	WM	4	
Width of inner shoulder	WIS	0	
Emission line distance from road centreline	(WL*NL+2*WIS+WM)/2	7.25	**All measurements are in meters**

Figure 4.1: Sample Calculation of Road Emission Line

Table 4.3: Traffic Volume Calculation for Traffic Zone – KM8.5 (Bishkek) to KM35.0 (Sadove)

Hourly Traffic Count by Vehicle Type

Vehicle Type	Car	Light Truck Pick Up	Light Bus/Van	Medium and Large Bus	Medium Truck 2-axle	Heavy Truck 3-axle	Truck Trailer	Truck Semi-Trailer	Tractor	Total
07 to 08 AM	2,808	82	538	25	20	24	9	9	0	**3,515**
08 to 09 AM	2,570	104	456	11	20	13	9	17	0	**3,200**
09 to 10 AM	2,476	69	428	14	20	31	6	29	0	**3,073**
10 to 11 AM	2,029	172	456	14	43	21	9	21	0	**2,765**
11 to 12 AM	2,155	143	469	13	47	21	6	37	1	**2,892**
12 to 13 PM	2,226	134	326	13	35	18	8	27	0	**2,787**
13 to 14 PM	1,970	100	400	11	40	28	9	21	2	**2,581**
14 to 15 PM	2,123	103	343	16	31	32	9	20	1	**2,678**
15 to 16 PM	1,972	97	379	14	37	38	4	20	2	**2,563**
16 to 17 PM	2,194	143	429	8	42	33	11	34	1	**2,895**
17 to 18 PM	2,534	133	458	12	33	35	10	38	0	**3,253**
18 to 19 PM	1,554	103	404	14	39	29	10	17	0	**2,170**
19 to 20 PM	2,729	101	328	22	29	20	7	28	0	**3,264**
20 to 21 PM	1,875	69	259	13	12	22	9	19	1	**2,279**
21 to 22 PM	1,446	51	225	19	17	7	7	12	0	**1,784**
22 to 23 PM	1,583	27	137	0	10	3	3	10	0	**1,773**
23 to 00 PM	1,256	32	154	0	7	5	0	6	0	**1,460**
00 to 01AM	864	12	55	0	0	3	1	4	0	**939**
01 to 02 AM	627	6	15	0	1	1	2	5	0	**657**
02 to 03 AM	312	7	16	0	0	1	1	4	0	**341**

Vehicle Type	Car	Light Truck Pick Up	Light Bus/Van	Medium and Large Bus	Medium Truck 2-axle	Heavy Truck 3-axle	Truck Trailer	Truck Semi-Trailer	Tractor	Total
03 to 04 AM	185	5	21	1	3	0	0	6	0	**221**
04 to 05 AM	142	10	16	0	2	0	0	1	0	**171**
05 to 06 AM	220	14	86	8	4	2	4	4	0	**342**
06 to 07 AM	1,432	22	223	24	7	10	7	7	0	**1,732**

Calculated Traffic Count for SoundPLAN by Day-Night and Vehicle Size

Location: Bishkek, KM8.5	Cars	Trucks	Total
Day	Total: 40,163 Hourly: 2,678	Total: 1,536 Hourly: 102	**41,699**
Night	Total: 7,479 Hourly: 831	Total: 157 Hourly: 17	**7,636**

Note

	Day: 7am to 10pm, Cars: Car, light truck/pick up, light bus/van
	Day: 7am to 10pm, Trucks: Medium and large bus, medium truck 2-axle, heavy truck 3-axle, truck trailer, truck semi-trailer, tractor
	Night: 10pm to 7am, Cars: Car, light truck/pick up, light bus/van
	Night: 10pm to 7am, Trucks: Medium and large bus, medium truck 2-axle, heavy truck 3-axle, truck trailer, truck semi-trailer, tractor

4.2 Results and Discussion for Representative Sections

44. The day and nighttime noise contours for the entire 7.4 km of road section modeled are included as **Annex I**.

45. Noise contours for representative section of different population categories are discussed in this section. The section under consideration is categorized as “inside population centers.”

46. Areas inside population centers are classified as no, low and high congestion areas.

No Congestion Areas

47. These are the areas where there is no or negligible population and the speeds are high as 80 km/h. **Figure 4.2** shows an example nighttime noise contour for section KM15.6 – KM15.9. The contours are streamlined and appear as smooth lines without any interference of the structures. The last contour observed at a distance of 100 m from the road centerline is of 50 dBA to 55 dBA.

Low Congestion Areas

48. These are the areas where there are scattered structures and are non-uniformly distributed on both sides of the road. **Figure 4.3** shows an example nighttime noise contours for section KM13.1 – KM13.6. The contours lines are affected by each structure coming in the path but are somewhat streamlined and similar to those for no congestion areas. Also, the 50 dBA to 55 dBA area comes closer to the road centerline (approximately at 40 m from the road centerline) where there are structures, beyond which the distance again increases and the 50 dBA to 55 dBA contours is located at a distance of approximately 90 m from the road centerline.

High Congestion Areas

49. These are the areas where there are concentrated structures that are more or less equally spaced and uniformly distributed on both sides of the road. **Figure 4.4** shows an example nighttime noise contour for section KM8.6 – KM9.1. It can be observed that the contours lines are affected by each structure coming in the path and the 55 dBA to 60 dBA area comes closer to the road centerline (approximately at 40 m from the road centerline) which will be beneficial for the structures behind first row.

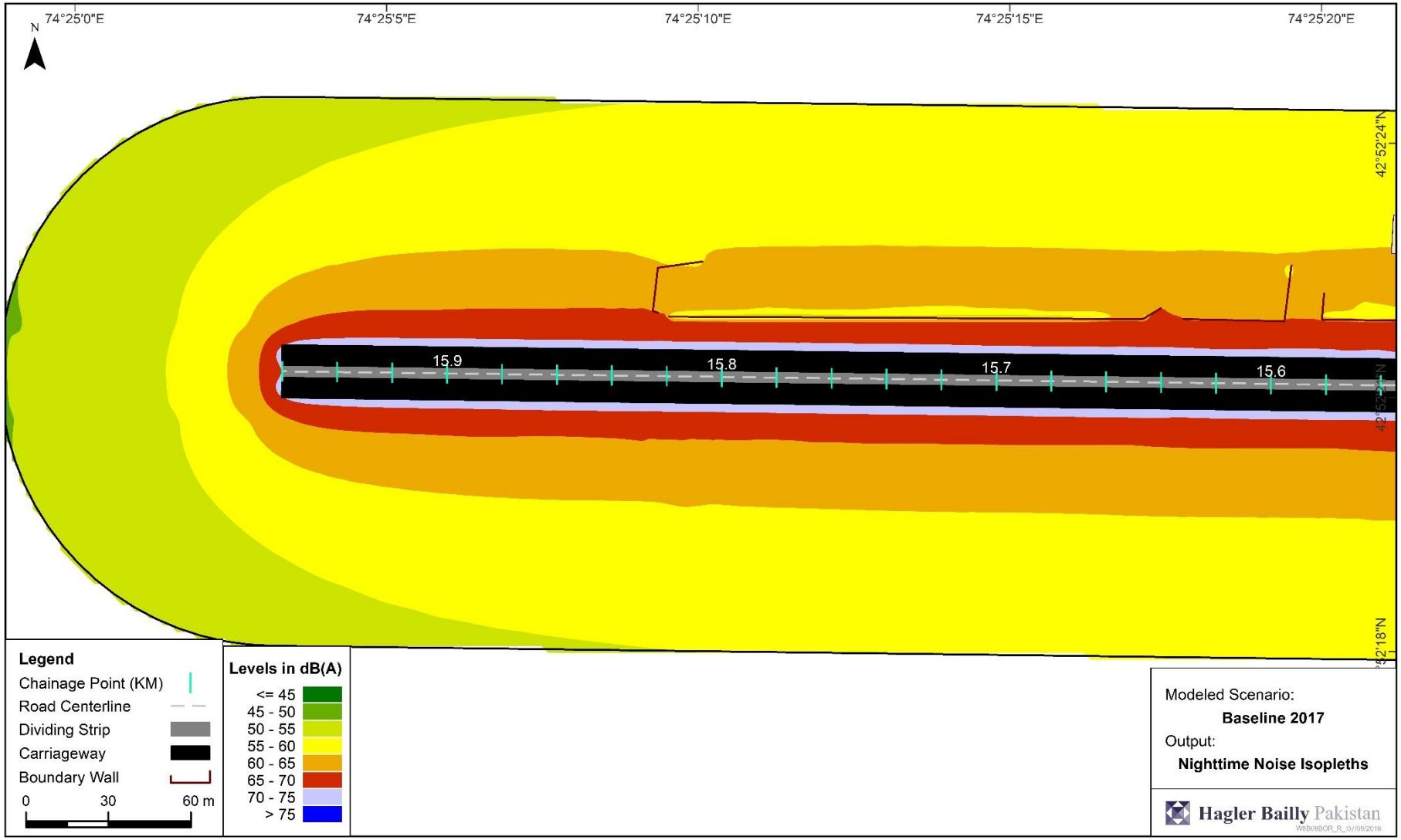


Figure 4.2: No Settlement Area - Nighttime Noise Isopleths

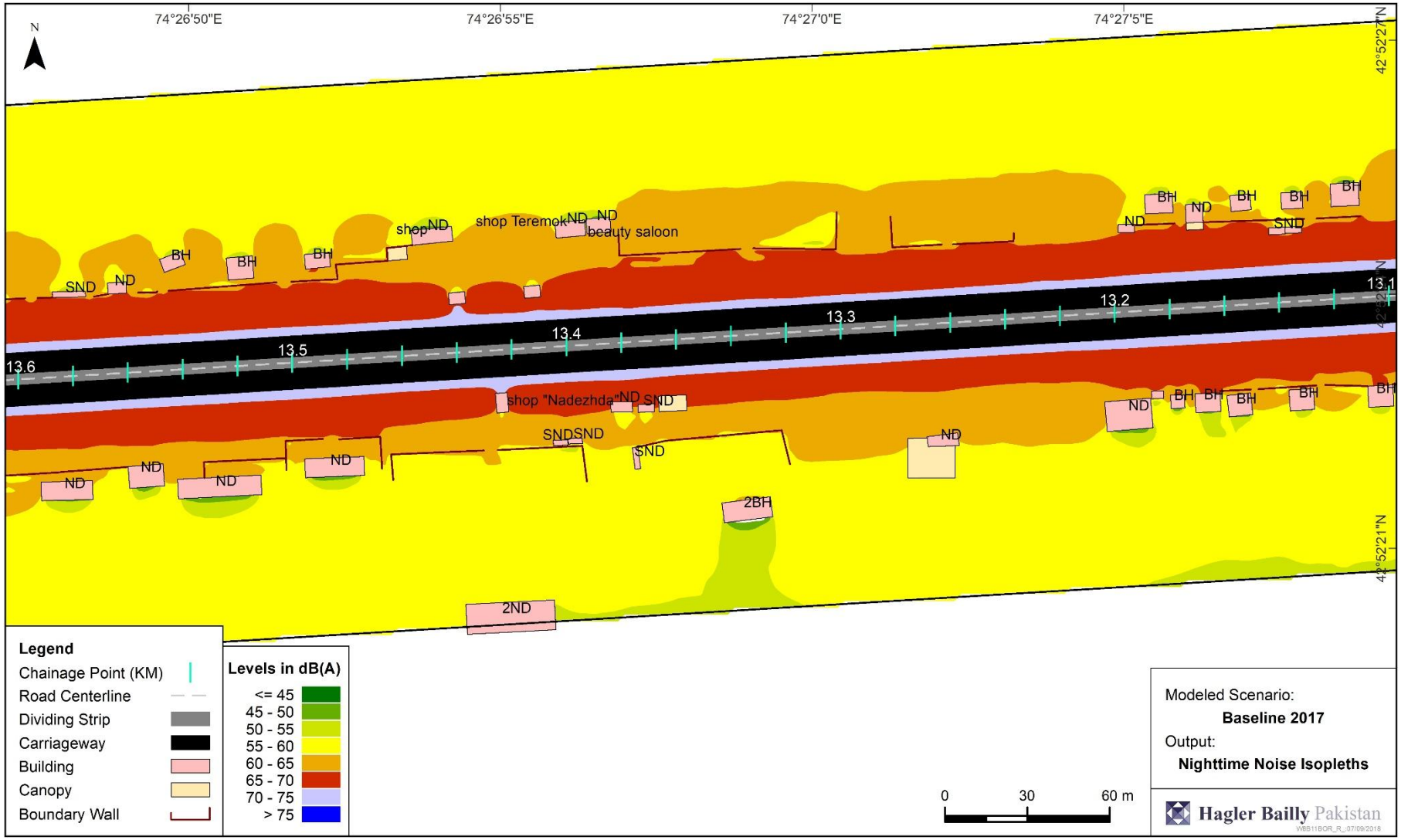


Figure 4.3: Low Congestion Areas - Nighttime Noise Isopleths

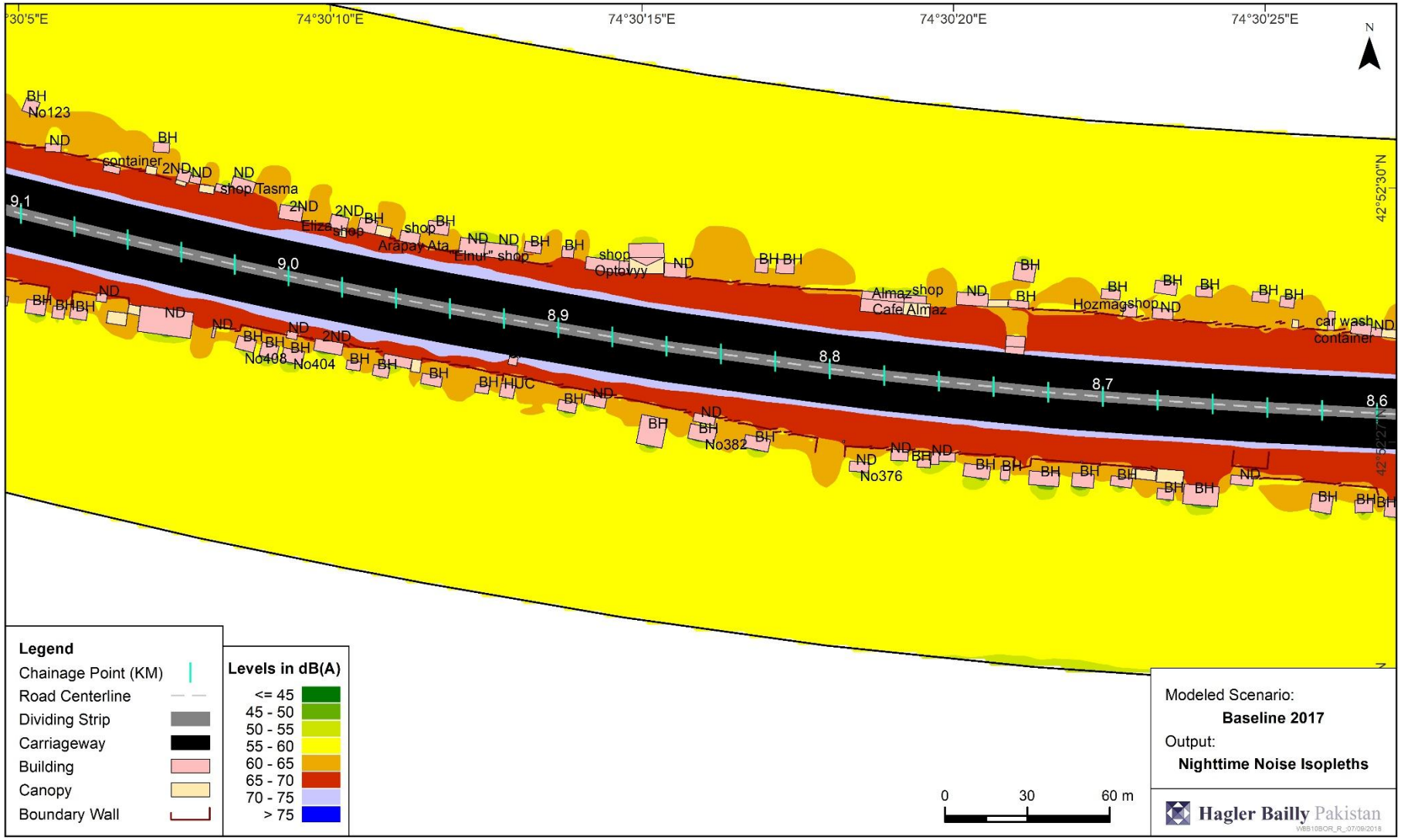


Figure 4.4: High Congestion Areas - Nighttime Noise Isopleths

4.3 Predicted Baseline Noise Levels at Selected Receivers

50. **Table 4.4** provides baseline noise levels for selected receivers. The baseline noise levels far exceed the Kyrgyz and IFC day and nighttime limit of 55 dBA and 45 dBA, respectively. On average, the day and nighttime noise levels exceed the 55 dBA and 45 dBA limits by 14 dBA and 18 dBA, respectively.

51. **Figure 4.5** to **Figure 4.8** shows graphical setting of the receivers along with their noise levels.

Table 4.4: Receiver Baseline Noise Levels

Receiver No.	X (longitude)	Y (latitude)	Building Side	Floor	Day (dBA)	Night (dBA)	Exceedance from 55 dBA (Day)	Exceedance from 45 dBA (Night)
R1	458398.10	4747050.51	North	1	72.8	66.7	17.8	21.7
				2	73.2	67.1	18.2	22.1
R2	458818.97	4747068.22	North	1	67.4	61.3	12.4	16.3
				2	72.0	65.9	17.0	20.9
R3	458943.44	4747067.04	North	1	69.6	63.5	14.6	18.5
				2	70.8	64.7	15.8	19.7
R4	456099.53	4746906.25	North	1	67.5	61.4	12.5	16.4
				2	69.6	63.6	14.6	18.6
R5	454147.65	4746864.38	South	1	68.4	62.3	13.4	17.3
				2	69.0	62.9	14.0	17.9
R6	456235.10	4746997.59	South	1	67.4	61.3	12.4	16.3
				2	68.5	62.4	13.5	17.4
R7	454534.69	4746797.07	North	1	65.9	59.9	10.9	14.9
				2	67.2	61.1	12.2	16.1
R8	455056.63	4746819.26	North	1	64.7	58.6	9.7	13.6
				2	65.5	59.4	10.5	14.4
R9	457541.52	4746989.13	North	1	67.3	61.2	12.3	16.2
				2	68.6	62.5	13.6	17.5
				3	69.5	63.4	14.5	18.4
R10	456770.13	4746938.43	North	1	66.8	60.7	11.8	15.7
				2	67.8	61.8	12.8	16.8
				3	68.7	62.6	13.7	17.6
R11	457690.84	4747015.46	North	1	72.6	66.5	17.6	21.5
				2	73.0	66.9	18.0	21.9
				3	73.0	66.9	18.0	21.9

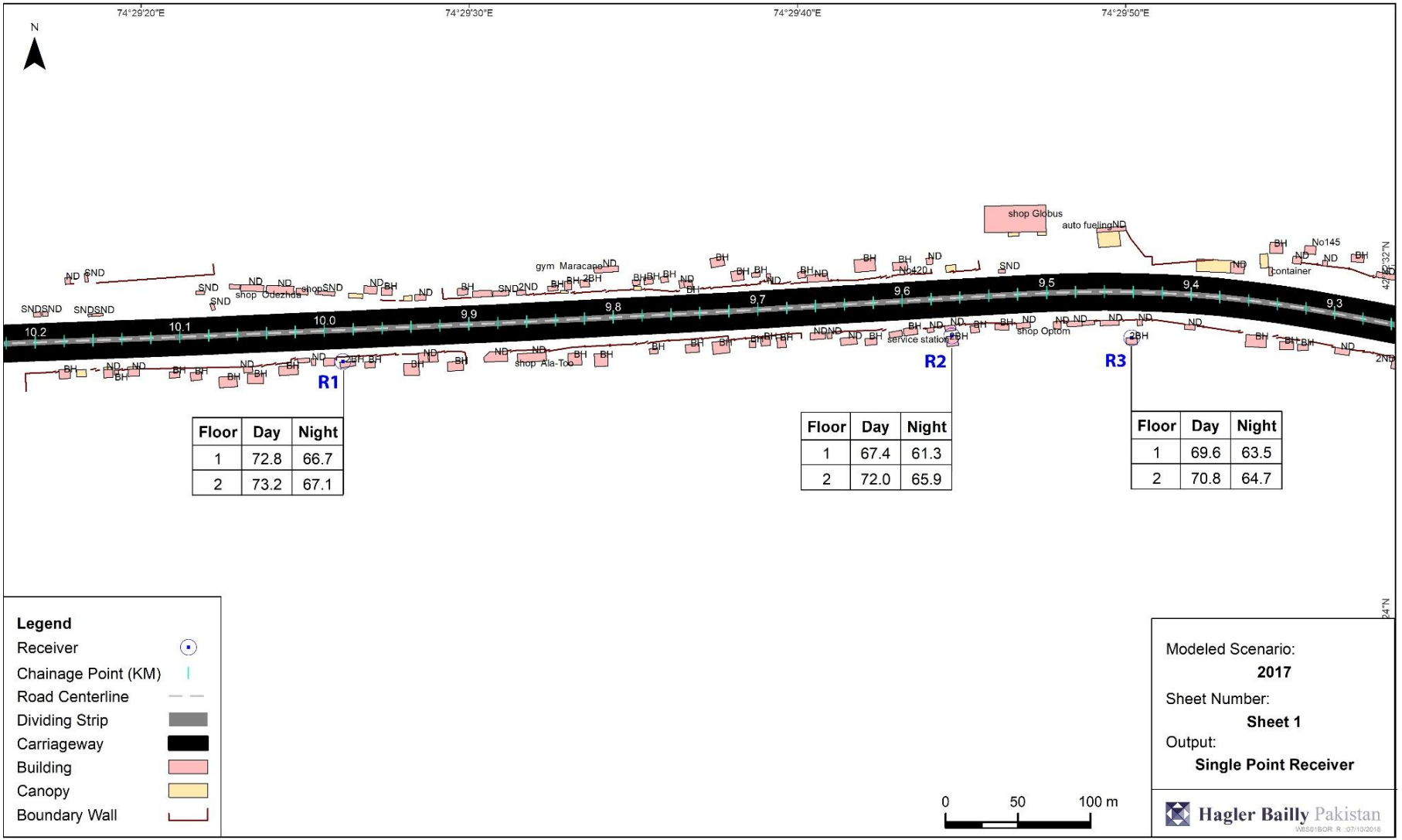


Figure 4.5: Baseline 2017 – Single Point Receiver (Receivers 1, 2 and 3)

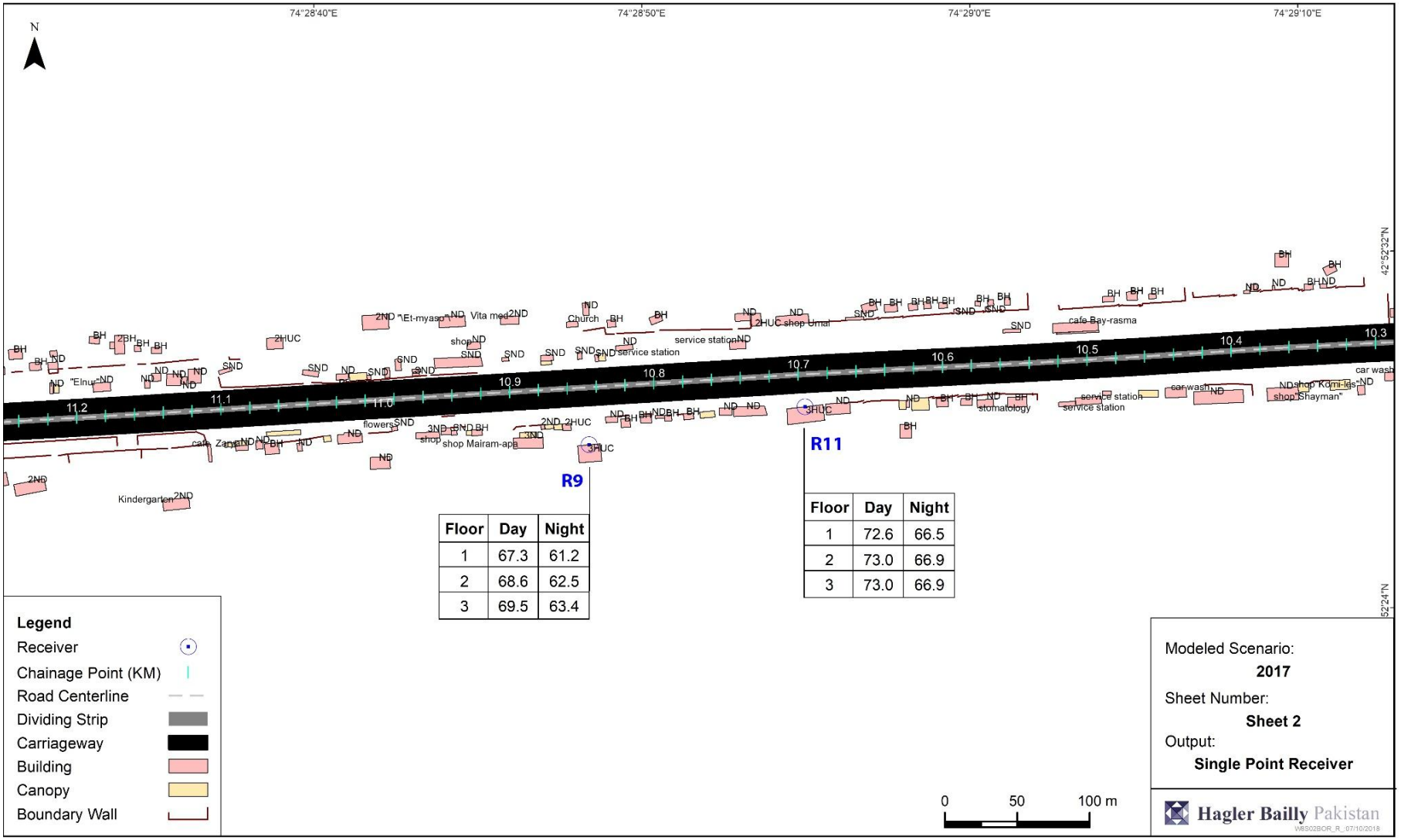


Figure 4.6: Baseline 2017 – Single Point Receiver (Receivers 9 and 11)

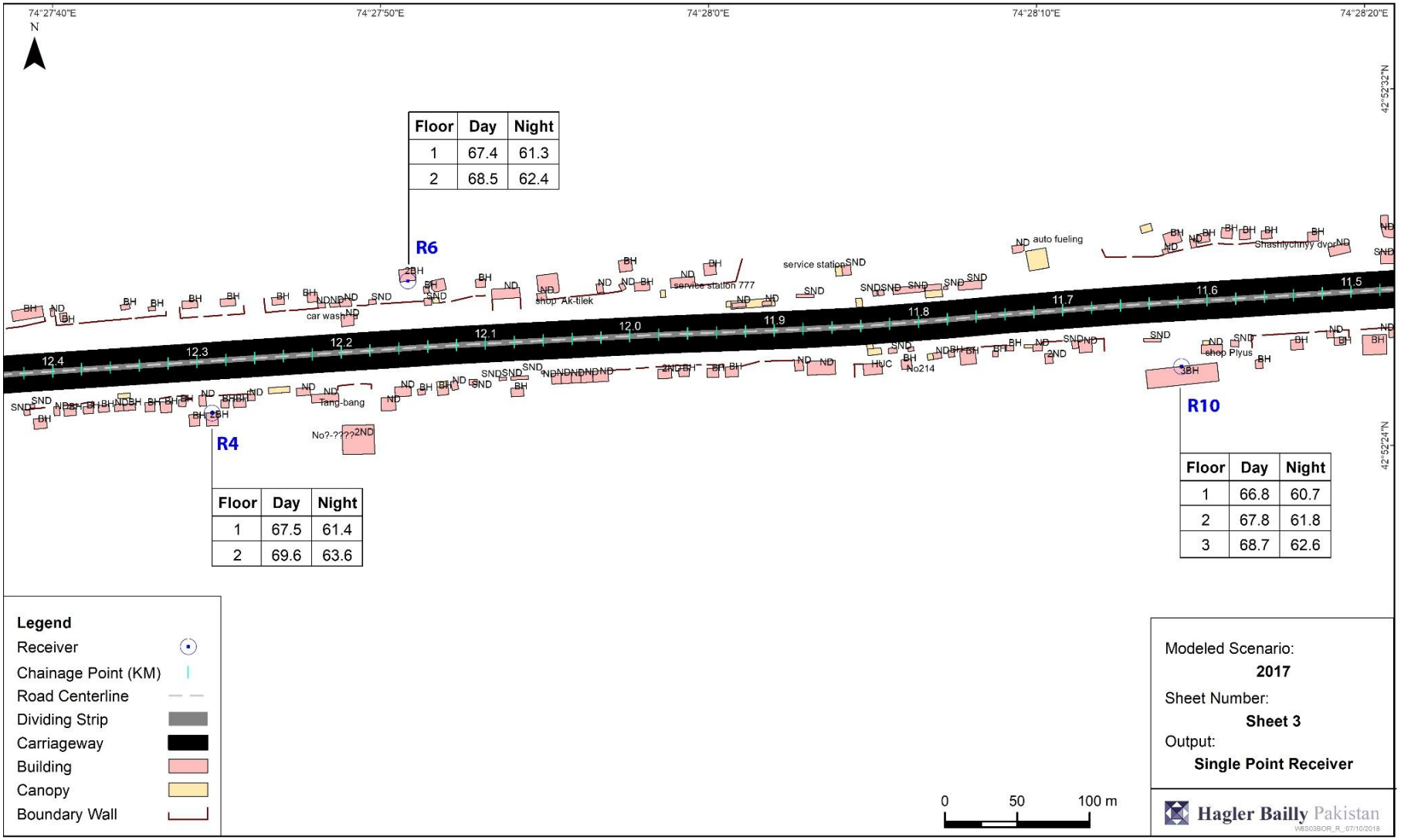


Figure 4.7: Baseline 2017 – Single Point Receiver (Receivers 4, 6 and 10)

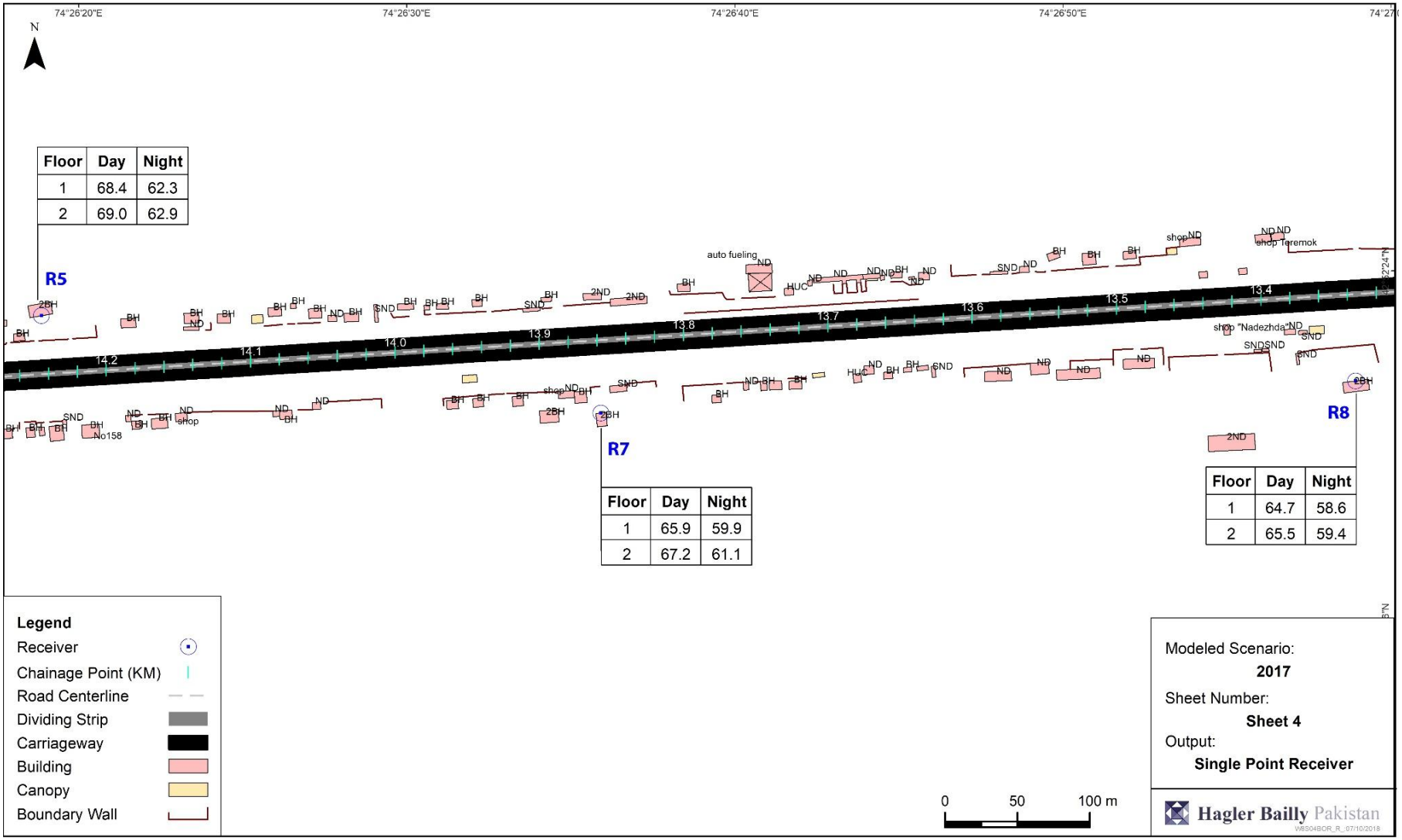


Figure 4.8: Baseline 2017 – Single Point Receiver (Receivers 5, 7 and 8)

4.4 Conclusions

52. The analysis provided in this section leads to the following conclusions:

- The simulated noise levels for the present road conditions, traffic, and vehicle speeds can be considered as the baseline noise levels for comparison with future scenarios and for assessing the incremental impact during construction and operation phases.
- The baseline noise levels already exceed the Kyrgyz and IFC day and nighttime limit by an average of 14 dBA and 18 dBA, respectively. For compliance purposes, it would be appropriate to use IFC guideline of baseline + 3 dBA.

5. Construction Noise Levels

53. The objective of construction noise modeling is to predict the maximum likely increment of noise over the baseline condition, attributable to construction activity. The inherent variability in construction noise makes it very difficult to predict. There are manifold variations:

- There are different stages of construction and in each stage different sets of equipment are deployed.
- The number of equipment in a given stage may vary on a daily basis owing to variation in work.
- The equipment is not stationary but move along the construction site.
- The noise of the equipment varies depending on the activity level. In a typical day, its state may vary between powered off (zero noise) to idling (low noise) to full throttle (highest noise) and anywhere between idling and full throttle.
- The noise at source may also vary depending on the manufacturer, age of the equipment, its maintenance condition, and whether noise suppressing shields are installed on it or not.

54. Nevertheless, a reasonable prediction of the scale of noise levels can be made by simulating various deployment configurations for the equipment.

5.1 Approach and Methodology

55. The equipment noise level has been taken from a comprehensive inventory of construction equipment noise measurements developed by the FHWA of the United States.[11] The selected list of equipment and their noise specifications is shown in **Table 5.1**, including:

- The *acoustical usage factor* assumed for calculating the equivalent sound pressure levels of different equipment. The acoustical usage factor is the estimate of the fraction of time during each work cycle that a piece of construction equipment is operating at full power i.e., at its loudest condition;
- The maximum noise limit for each piece of equipment provided in manufacturers' specifications, expressed as Lmax in dBA at a reference distance of 50 foot (15 m) from the loudest side of the equipment, referred here as "*Sound Pressure Level (SPL) specified by Manufacturers*; and
- The emission level as measured by FHWA at 50 foot (15 m) for each piece of equipment. It is the average of hundreds of emission measurements performed at construction sites. It is referred here as "*SPL measured by FHWA*." This is the preferred baseline measurement and the one used in this study.

56. FHWA found that the measured noise levels were lower than those in the specification in most case. FHWA, therefore, recommends using the measured noise levels, unless more reliable information specific to the equipment to be used is available.

[11] Federal Highway Authority, Construction Noise Handbook, August 2006, https://www.fhwa.dot.gov/ENVIRONMENT/noise/construction_noise/handbook/handbook09.cfm.

Table 5.1: Equipment Noise Specifications Recorded at 15 m from Source

Equipment	Acoustical Usage Factor	SPL specified by Manufacturers, L_{max}, dBA	SPL measured by FHWA, L_{max}, dBA
Backhoe	40%	80	78.0
Concrete Mixer Truck	40%	85	78.8
Dump Truck	40%	84	76.5
Front End Loader	40%	80	79.1
Grader	40%	85	
Paver	50%	85	77.2
Roller	20%	85	80.0
Water Sprayer	40%	55	75.0

Source: Federal Highway Authority, Construction Noise Handbook, August 2006

57. The construction activity on the road section in front of the receivers has been split into four stages (**Table 5.2**)**.**

Table 5.2: Construction Stages

Modeling Stage	Activity
A. Preparation	Removal and relocation of utilities using manual labor, backhoe and loader
Ignored because of its similarity of Previous activity	Removal of topsoil from earthen shoulders and areas were widening is to take place
B. Asphalt Breaking	Breaking of asphalt, loading onto trucks and transport to storage site
C. Subgrade	Placement of new subgrade and compactions
D. Asphalt Laying	Placement of new Asphalt concrete with paving machine

58. For the purpose of modeling, it is assumed that any piece of equipment located more than 200 m from the receptor will not affect the noise levels at the receptor. This assumption is based on comparison of existing typical traffic noise and the noise from the loudest equipment. Beyond 200 m, the noise from the existing traffic will dominate the construction noise. Therefore, a 400 m construction zone is assumed.

59. Two configurations have been considered. *Typical Configuration* is the one that is expected to prevail most of the time normal construction practices take place. The E*xtreme Configuration* is likely to occur occasionally, i.e., less than 10% of the time. Typical number and types of equipment for each configuration is provided in **Table 5.3**. The equipment is placed on the road (a modeling assumption) at uniform distances, 50 m apart in extreme configuration and 100 m apart in Typical Configuration.

Table 5.3: Equipment Deployment in Different Configurations

Equipment	Stage A. Preparation	Stage B. Asphalt Breaking	Stage C. Sub-base and Base	Stage D. Asphalt Laying
Extreme Configuration				
Backhoe	2	4		
Concrete Mixer Truck				2
Dump Truck	4	2	4	
Front End Loader	2	2		
Grader			2	
Paver				2
Roller			1	2
Water Sprayer			1	2
Typical Configuration				
Backhoe	1	2		
Concrete Mixer Truck				1
Dump Truck	2	1	1	
Front End Loader	1	1		
Grader			1	
Paver				1
Roller			1	1
Water Sprayer			1	1

5.2 Inputs Variable Parameters

60. The variable parameters of the model used for construction noise simulations are listed and described in **Table 5.4**.

Table 5.4: Variable Parameters of the Model

Parameter	Description
Road width and emission line	The widths for existing road are taken from the file named “Explanatory note FINAL EN –Table 3.1.3. Existing and projected width of road section Bishkek – Kara-Balta at Page No. 23.” Traffic noise was assumed to come from a line located at the center of the carriageway. This line, the *emission line*, was defined with respect to the road centerline. For dual carriage highway, there will be two emission lines, one in each direction. In the SoundPLAN, the distance of the emission line from the road centerline was entered. The distance from the centerline depends on the width of the median, number of lanes and the width of each lane as follows: Emission Line (m) = $(W_L \times N_L + 2\,W_{IS} + W_M)/2$ Where: W_L = Width of each lane N_L = Number of lanes on each carriageway W_{IS} = Width of inner shoulder W_M = Width of median

<table>
<tr><th>Parameter</th><th>Description</th></tr>
<tr><td></td><td>Table 5.5 provides the widths of carriageway and distances of emission lines for the existing road. Figure 4.1 shows an example of the calculation of emission lines.</td></tr>
<tr><td>Traffic volume</td><td>Traffic volume for the construction period (assumed as year 2018 and 2019) was taken from the 2017 traffic and on this a growth rate of 7% per year for passenger cars and 4% per year for trucks and buses was applied. This growth rate was taken from the IEE.[12] Hourly traffic volume for the three sections used in the modeling is given below.
Traffic Zone: Bishkek (KM9.0) – Sadove (KM35.0)
<table>
<tr><td>Year</td><td>Vehicle Type</td><td>Day</td><td>Night</td></tr>
<tr><td rowspan="2">2018</td><td>Cars</td><td>2,851</td><td>885</td></tr>
<tr><td>Trucks</td><td>107</td><td>18</td></tr>
<tr><td rowspan="2">2019</td><td>Cars</td><td>3,036</td><td>942</td></tr>
<tr><td>Trucks</td><td>111</td><td>19</td></tr>
<tr><td rowspan="2">2020</td><td>Cars</td><td>3,233</td><td>1,003</td></tr>
<tr><td>Trucks</td><td>115</td><td>20</td></tr>
</table></td></tr>
<tr><td>Vehicle speed</td><td>The speed for all modes of vehicle is taken as 60 km/h.</td></tr>
<tr><td>Pavement</td><td>Asphalt concrete with considerable roughness that adds 2 dBA to the noise levels due to poor condition of the road.</td></tr>
<tr><td>Construction equipment</td><td>Point source noise is usually associated with a source that remains in one place for extended periods, as is the case with most construction activities. Examples of point sources of noise include use of pile drivers, jackhammers, rock drills, or excavators working in one location. However, noise from a single traveling vehicle is also considered a point source of noise.[13] Therefore, all pieces of construction equipment were modeled as point sources. SoundPLAN takes the sound power level (SWL) of the equipment and calculates the SPL at the receiver. Table 5.6 shows the SWL for each piece of construction equipment calculated from its SPL.</td></tr>
</table>

Table 5.5: Road Widths

Road Section	No. of Lanes	Each Lane Width (m)	Dividing Strip (m)	Road Width (m)	Distance of Emission Line (from road centerline) (m)
KM8.5-KM13.0	6	3.5	4.0	25.0	7.25
KM13.0-KM15.9	4	3.75	4.0	19.0	5.75

[12] Initial Environmental Examination of CAREC Transport Corridor 3 (Bishkek – Osh Road) Improvement Project, Phase 4 Engineering and construction supervision for Ministry of Transport and Communications of the Kyrgyz Republic, Prepared by KOCKS Consult GmbH (2013) and revised by EPTISA Servicios De Ingenieria S.L./Eptisa Muhendislik/RAM Engineering (2015), September 30, 2015.

[13] https://www.nrc.gov/docs/ML1225/ML12250A723.pdf

Table 5.6: Sound Power Levels of the Construction Equipment

Equipment	Usage	SPL - Spec. Lmax (15m)	SPL - Actual Lmax (15m)	SPL - Leq (15m)	SPL - Spec. Leq (1m)	SWL
Backhoe	40%	80	77.6	73.62	97.14	108.02
Concrete Mixer Truck	40%	85	78.8	74.82	98.34	109.22
Dump Truck	40%	84	76.5	72.52	96.04	106.92
Front End Loader	40%	80	79.1	75.12	98.64	109.52
Grader	40%	85		81.02	104.54	115.42
Paver	50%	85	77.2	74.19	97.71	108.58
Roller	20%	85	80	73.01	96.53	107.40
Water Sprayer	40%	55	75	71.02	94.54	105.42

SPL-Sound pressure level, SWL-Sound power level; see Section 1.1 for definitions

5.3 Predicted Construction Noise Levels

5.3.1 No Construction Impact

61. The predicted noise levels in 2018, 2019 and 2020 (construction period) without construction work are presented in **Table 5.7**. These noise levels are only due to projected traffic in 2018, 2019 and 2020 with baseline road conditions. **Table 5.7** also shows the increment over baseline noise levels.

62. On average, there is an increase of 0.2 dBA, 0.5 dBA and 0.7 dBA from baseline (2017) in 2018, 2019 and 2020, respectively, notwithstanding that estimated baseline levels far exceed both Kyrgyz and IFC noise standard (Table 4.4) for day and night.

5.3.2 With Construction Impact

63. **Table 5.8** shows an average increase over the baseline in respective stages of construction during day and nighttime with Typical Configuration. It can be seen that daytime noise levels only exceed the IFC guideline of baseline + 3 dBA in stage C configuration (Table 5.3) by 1 dBA, respectively during the construction period. The nighttime noise levels exceed in all stages. During nighttime the levels exceed by an average of 1.3 dBA, 2.1 dBA, 5.0 dBA and 1.5 dBA in stages A, B, C and D, respectively.

64. **Table 5.9** shows an average increase over the baseline in respective stages of construction during day and nighttime with Extreme Configuration. The day and nighttime noise levels exceed in all stages. During daytime the levels exceed by an average of 0.4 dBA, 1.3 dBA, 3.9 dBA and 0.7 dBA in stages A, B, C and D, respectively. During nighttime the levels exceed by an average of 4.4 dBA, 5.7 dBA, 8.9 dBA and 4.9 dBA in stages A, B, C and D, respectively.

Table 5.7: Predicted Noise Levels (dBA) without Construction Work

No	F	2017		2018		IOB		2019		IOB		2020		IOB	
		D	N	D	N	D	N	D	N	D	N	D	N	D	N

R1	1	72.8	66.7	73.1	67.0	0.3	0.3	73.3	67.3	0.5	0.6	73.5	67.5	0.7	0.8
	2	73.2	67.1	73.5	67.4	0.3	0.3	73.7	67.6	0.5	0.5	73.9	67.9	0.7	0.8
R2	1	67.4	61.3	67.7	61.6	0.3	0.3	67.9	61.9	0.5	0.6	68.1	62.1	0.7	0.8
	2	72.0	65.9	72.2	66.2	0.2	0.3	72.4	66.4	0.4	0.5	72.7	66.7	0.7	0.8
R3	1	69.6	63.5	69.9	63.8	0.3	0.3	70.1	64.1	0.5	0.6	70.3	64.3	0.7	0.8
	2	70.8	64.7	71.0	65.0	0.2	0.3	71.3	65.2	0.5	0.5	71.5	65.5	0.7	0.8
R4	1	67.5	61.4	67.8	61.7	0.3	0.3	68.0	62.0	0.5	0.6	68.2	62.2	0.7	0.8
	2	69.6	63.6	69.9	63.8	0.3	0.2	70.1	64.1	0.5	0.5	70.3	64.3	0.7	0.7
R5	1	68.4	62.3	68.6	62.6	0.2	0.3	68.8	62.8	0.4	0.5	69.1	63.1	0.7	0.8
	2	69.0	62.9	69.3	63.2	0.3	0.3	69.5	63.5	0.5	0.6	69.7	63.7	0.7	0.8
R6	1	67.4	61.3	67.7	61.6	0.3	0.3	67.9	61.9	0.5	0.6	68.1	62.1	0.7	0.8
	2	68.5	62.4	68.7	62.6	0.2	0.2	68.9	62.9	0.4	0.5	69.1	63.2	0.6	0.8
R7	1	65.9	59.9	66.2	60.1	0.3	0.2	66.4	60.4	0.5	0.5	66.6	60.6	0.7	0.7
	2	67.2	61.1	67.4	61.4	0.2	0.3	67.7	61.6	0.5	0.5	67.9	61.9	0.7	0.8
R8	1	64.7	58.6	65.0	58.9	0.3	0.3	65.2	59.2	0.5	0.6	65.4	59.4	0.7	0.8
	2	65.5	59.4	65.7	59.7	0.2	0.3	65.9	59.9	0.4	0.5	66.2	60.2	0.7	0.8
R9	1	67.3	61.2	67.5	61.5	0.2	0.3	67.8	61.7	0.5	0.5	68.0	62.0	0.7	0.8
	2	68.6	62.5	68.8	62.8	0.2	0.3	69.1	63.0	0.5	0.5	69.3	63.3	0.7	0.8
	3	69.5	63.4	69.7	63.7	0.2	0.3	69.9	63.9	0.4	0.5	70.2	64.2	0.7	0.8
R10	1	66.8	60.7	67.0	61.0	0.2	0.3	67.2	61.2	0.4	0.5	67.5	61.5	0.7	0.8
	2	67.8	61.8	68.1	62.0	0.3	0.2	68.3	62.3	0.5	0.5	68.5	62.5	0.7	0.7
	3	68.7	62.6	68.9	62.8	0.2	0.2	69.1	63.1	0.4	0.5	69.3	63.3	0.6	0.7
R11	1	72.6	66.5	72.9	66.8	0.3	0.3	73.1	67.1	0.5	0.6	73.3	67.3	0.7	0.8
	2	73.0	66.9	73.2	67.2	0.2	0.3	73.4	67.4	0.4	0.5	73.7	67.7	0.7	0.8
	3	73.0	66.9	73.2	67.1	0.2	0.2	73.4	67.4	0.4	0.5	73.7	67.7	0.7	0.8

Note: R = Receiver, F = Floor, D = Day, N = Night, IOB=increase over baseline

Table 5.8: Increment over Baseline during Typical Configuration (dBA)

Year	Stage A		Stage B		Stage C		Stage D	
	Day	Night	Day	Night	Day	Night	Day	Night
2018	1.6	4.2	2.0	5.0	3.7	7.9	1.8	4.4
2019	1.7	4.3	2.2	5.1	3.8	8.0	1.9	4.5
2020	2.0	4.5	2.4	5.2	3.9	8.1	2.0	4.6

Table 5.9: Increment over Baseline during Extreme Configuration (dBA)

Year	Stage A	Stage B	Stage C	Stage D

	Day	Night	Day	Night	Day	Night	Day	Night
2018	3.3	7.3	4.2	8.7	6.9	11.9	3.6	7.9
2019	3.4	7.4	4.3	8.7	6.9	11.9	3.7	7.9
2020	3.5	7.5	4.4	8.8	7.0	12.0	3.8	8.0

5.4 Suggested Mitigation Measures

65. It is anticipated that noise from construction activities will be a source of nuisance to the community, unless managed properly. A list of mitigation measures is proposed. The suggested measures that can be considered are as follows:

- **Construction Planning**. Many noise issues can be avoided by planning the construction activities in a manner that minimizes the disturbance to the community. Some suggested measures are:
  - Prefer newer equipment over older equipment as newer equipment is generally quieter because of technological advancements, and lack of wear and tear, worn out, loose, and damaged components.
  - Locate storage area and vehicle yards in a manner that minimizes the travel time for construction vehicles.
  - Pay attention to equipment at a particular location. By careful planning the number of machines/equipment operating at a specific location at the same, noise exposure can be reduced to the extent that compliance with the noise criteria is achieved. This may not be possible for certain type of equipment or certain activities and as a result noise levels may exceed the criteria for certain period of time. In that case, schedule several noisy operations concurrently. This is advantageous because the combined noise levels of several noisy pieces of equipment may not be significantly greater than the level produced if the operations were performed separately. In other words, adding another piece of equipment to an already noisy operation may not be noticeable at the receptors, but running the operation for longer periods will add to the nuisance.
- **Noise Control at Source**. Taking measures to prevent emission of potentially offensive noise, or source control, is, in general, the most effective form of noise mitigation.[14] Some suggested measures are:
  - Avoid using equipment with high intrinsic noise levels (amounts to disallowing old equipment and those with poor maintenance)
  - Install mufflers on air intake and exhaust of all equipment. The mufflers are standard part of equipment, however, the wear and tear results in degradation of their performance and shall be regularly inspected, repaired and replaced if needed. In addition, availability of additional mufflers for further reduction in noise levels shall be investigated.
  - Noise shields, physically attached to the piece of equipment, shall be provided to stationary equipment.

[14] Federal Highway Authority. *Construction Noise Handbook*.

  - Provide a regular inspection and maintenance procedure for all pieces of equipment focused on sources of noise and noise control components. This may include, for example, a) cleaning and, if needed, replacement of faulty or damaged mufflers, and b) tightening of loose screws and bolts of metal plates and engine parts to minimize vibration.

- **Equipment Operation Training**. According to US FHWA,[15] careless or improper operation or inappropriate use of equipment can increase noise levels. Poor loading and unloading, excavation, and hauling techniques are examples of how lack of adequate guidance and training may lead to increased noise levels. It is suggested that:
  - The contractor will maintain a training plan for all equipment operators that, among other will, shall also include techniques for reduction in noise.
  - No operator shall be allowed to operate an equipment, unless he/she has received training on its operation.
- **Night Construction**. Any type of construction activity during the night will not be allowed.
- **Distance Attenuation**: As construction equipment is considered as the point source and the standard reduction for point source noise is 6 dBA per doubling of distance from the source.

5.5 Conclusions

66. The observations are as follows:

- On average the traffic noise in 2018, 2019 and 2020 is likely to increase by an average of 0.2 dBA, 0.5 dBA and 0.7 dBA respectively. There is a marginal difference in construction noise levels between 2018, 2019 and 2020, which is undetectable to the human ear.
- The noisiest stage is Stage C, both during Typical and Extreme Configurations. During this stage, noise levels exceed the IFC guideline by an average of 1 dBA and 3.9 dBA, respectively during daytime and 3.9 dBA and 8.9 dBA, respectively, during nighttime.

67. In summary, the increment over baseline during the active construction period with the maximum number of construction equipment deployed at the same time, which is estimated to occur only 10% of the time could be as much as 7 dBA over baseline during day for certain period of the day. However, for the Typical Configuration, likely occurring about 90% of the time, the increase in noise is around 3.9 dBA. The impact of this increase depends on the total duration of the activity and the receptors.

68. The construction period (time that work is taking place) in any 400 m section modeled is not known. However, an estimate can be made on the basis:

[15] The Federal Highway Administration (FHWA) provides stewardship over the construction, maintenance and preservation of the Nation's highways, bridges and tunnels. FHWA also conducts research and provides technical assistance to state and local agencies in an effort to improve safety, mobility, and livability, and to encourage innovation.

- Total length of road: 7.4 km
- Total construction period: April-October 2017-2020; be up to 42 months
- Number of teams: 4 (assumed)
- Progress per team per month: 0.044 km (7.4/42/4)
- Time required for 400 m (4 teams together): 68 days

69. Therefore, 68 days is the estimated construction time within a 400 m road section. Irrespective of how the construction is planned, the total number of days of disturbance using a full range of equipment, applying the typical deployment scenario, an increase of no more than 3.9 dBA is predicted during daytime and during construction period.

6. Operational Noise Levels

70. To assess the noise increment during the operating period (Year 5, 10 and 15 after start of road operation) over the baseline, operation phase noise modeling was carried out.

6.1 Inputs Variable Parameters

71. The variable parameters of the model used for operation noise simulations are listed and described in **Table 6.1.**

Table 6.1: Variable Parameters of the Model

<table>
<tr><th>Parameter</th><th>Description</th></tr>
<tr><td>Road width and emission line</td><td>The widths for proposed road are taken from the file named “Explanatory note FINAL EN –Table 3.1.3. Existing and projected width of road section Bishkek – Kara-Balta at Page No. 23.”
Traffic noise was assumed to come from a line located at the center of the carriageway. This line, the emission line, was defined with respect to the road centerline. For dual carriage highway, there will be two emission lines, one in each direction. In the SoundPLAN, the distance of the emission line from the road centerline was entered. The distance from the centerline depends on the width of the median, number of lanes and the width of each lane as follows:
Emission Line (m) = $(W_L \times N_L + 2\ W_{IS} + W_M)/2$
Where: W_L = Width of each lane
N_L = Number of lanes on each carriageway
W_{IS} = Width of inner shoulder
W_M = Width of median
Table 6.2 provides the widths of carriageway and distances of emission lines for the proposed road.</td></tr>
<tr><td>Traffic volume</td><td>Traffic volume for the operation phase for years 5, 10 and 15, i.e., 2025, 2030 and 2035, respectively was calculated from the 2017 traffic with a growth rate of 7% per year for passenger cars and 4% per year for trucks and buses. This growth rate was taken from the IEE.[16] This is considered as the full traffic that will be on the new road during the operating years.
Bishkek (KM9.0) – Sadove (KM35.0)
<table>
<tr><td>Year</td><td>Vehicle Type</td><td>Day</td><td>Night</td></tr>
<tr><td rowspan="2">2025</td><td>Cars</td><td>4,436</td><td>1,377</td></tr>
<tr><td>Trucks</td><td>140</td><td>24</td></tr>
<tr><td rowspan="2">2030</td><td>Cars</td><td>6,103</td><td>1,894</td></tr>
<tr><td>Trucks</td><td>171</td><td>29</td></tr>
<tr><td rowspan="2">2035</td><td>Cars</td><td>8,414</td><td>2,611</td></tr>
<tr><td>Trucks</td><td>207</td><td>35</td></tr>
</table></td></tr>
<tr><td>Vehicle</td><td>The speed for all modes of vehicles is taken as 60 km/h.</td></tr>
</table>

[16] Initial Environmental Examination of CAREC Transport Corridor 3 (Bishkek – Osh Road) Improvement Project, Phase 4 Engineering and construction supervision, prepared by KOCKS Consult GmbH (2013) and revised by EPTISA Servicios De Ingenieria S.L./Eptisa Muhendislik/RAM Engineering (2015), for Ministry of Transport and Communications of the Kyrgyz Republic, September 30, 2015.

Parameter	Description
speed	
Pavement	Smooth asphalt with no roughness that adds no noise due to improved condition of the road.

Table 6.2: Road Widths

Road Section	No. of Lanes	Each Lane Width (m)	Dividing Strip (m)	Road Width (m)	Distance of Emission Line (from road centerline) (m)
KM8.5-KM13.0	6	3.5	4.0	25.0	7.25
KM13.0-KM15.9	6	3.5	4.0	25.0	7.25

6.2 Predicted Operational Noise Levels

72. **Table 6.3, Table 6.4** and **Table 6.5** Provides the unmitigated operational noise levels in 2025, 2030 and 2035 at selected receivers. It can be seen that the operational noise levels at selected receivers in year 5, 10 and 15 follow the IFC guideline of baseline + 3 dBA. In **Table 6.3**, the day and nighttime increment is negative. It is because the operational noise levels after rehabilitation of road drops down even below the baseline noise levels which is why the difference of operational noise level in 2025 from the baseline is in negative.

Table 6.3: Predicted Operational Noise Levels in 2025 – Unmitigated

Receiver No.	F	2017		2025			
		Day	Night	Day	Night	Daytime Increment	Nighttime Increment
R1	1	72.8	66.7	72.7	66.7	-0.1	0.0
	2	73.2	67.1	73.1	67.1	-0.1	0.0
R2	1	67.4	61.3	67.3	61.3	-0.1	0.0
	2	72.0	65.9	71.8	65.9	-0.2	0.0
R3	1	69.6	63.5	69.5	63.5	-0.1	0.0
	2	70.8	64.7	70.6	64.7	-0.2	0.0
R4	1	67.5	61.4	67.4	61.4	-0.1	0.0
	2	69.6	63.6	69.5	63.5	-0.1	-0.1
R5	1	68.4	62.3	68.4	62.5	0.0	0.2
	2	69.0	62.9	69.0	63.0	0.0	0.1
R6	1	67.4	61.3	67.3	61.3	-0.1	0.0
	2	68.5	62.4	68.3	62.4	-0.2	0.0
R7	1	65.9	59.9	65.9	59.9	0.0	0.0
	2	67.2	61.1	67.1	61.2	-0.1	0.1
R8	1	64.7	58.6	64.6	58.7	-0.1	0.1

	2	65.5	59.4	65.4	59.5	-0.1	0.1
R9	1	67.3	61.2	67.1	61.2	-0.2	0.0
	2	68.6	62.5	68.4	62.5	-0.2	0.0
	3	69.5	63.4	69.3	63.4	-0.2	0.0
R10	1	66.8	60.7	66.6	60.7	-0.2	0.0
	2	67.8	61.8	67.7	61.8	-0.1	0.0
	3	68.7	62.6	68.5	62.6	-0.2	0.0
R11	1	72.6	66.5	72.5	66.5	-0.1	0.0
	2	73.0	66.9	72.8	66.9	-0.2	0.0
	3	73.0	66.9	72.8	66.9	-0.2	0.0

Note: F = Floor

Table 6.4: Predicted Operational Noise Levels in 2030 – Unmitigated

Receiver No.	F	2017		2030			
		Day	Night	Day	Night	Daytime Increment	Nighttime Increment
R1	1	72.8	66.7	73.8	68.0	1.0	1.3
	2	73.2	67.1	74.2	68.4	1.0	1.3
R2	1	67.4	61.3	68.5	62.6	1.1	1.3
	2	72.0	65.9	73.0	67.1	1.0	1.2
R3	1	69.6	63.5	70.7	64.8	1.1	1.3
	2	70.8	64.7	71.8	65.9	1.0	1.2
R4	1	67.5	61.4	68.6	62.7	1.1	1.3
	2	69.6	63.6	70.7	64.8	1.1	1.2
R5	1	68.4	62.3	69.6	63.7	1.2	1.4
	2	69.0	62.9	70.2	64.3	1.2	1.4
R6	1	67.4	61.3	68.5	62.6	1.1	1.3
	2	68.5	62.4	69.5	63.6	1.0	1.2
R7	1	65.9	59.9	67.1	61.2	1.2	1.3
	2	67.2	61.1	68.3	62.4	1.1	1.3
R8	1	64.7	58.6	65.8	59.9	1.1	1.3
	2	65.5	59.4	66.6	60.7	1.1	1.3
R9	1	67.3	61.2	68.3	62.4	1.0	1.2
	2	68.6	62.5	69.6	63.7	1.0	1.2
	3	69.5	63.4	70.5	64.6	1.0	1.2
R10	1	66.8	60.7	67.8	61.9	1.0	1.2

	2	67.8	61.8	68.9	63.0	1.1	1.2
	3	68.7	62.6	69.7	63.8	1.0	1.2
R11	1	72.6	66.5	73.6	67.8	1.0	1.3
	2	73.0	66.9	74.0	68.1	1.0	1.2
	3	73.0	66.9	74.0	68.1	1.0	1.2

Note: F = Floor

Table 6.5: Predicted Operational Noise Levels in 2035 – Unmitigated

Receiver No.	F	2017		2035			
		Day	Night	Day	Night	Daytime Increment	Nighttime Increment
R1	1	72.8	66.7	75.0	69.2	2.2	2.5
	2	73.2	67.1	75.4	69.6	2.2	2.5
R2	1	67.4	61.3	69.6	63.8	2.2	2.5
	2	72.0	65.9	74.2	68.4	2.2	2.5
R3	1	69.6	63.5	71.8	66.0	2.2	2.5
	2	70.8	64.7	73.0	67.2	2.2	2.5
R4	1	67.5	61.4	69.8	63.9	2.3	2.5
	2	69.6	63.6	71.9	66.0	2.3	2.4
R5	1	68.4	62.3	70.8	65.0	2.4	2.7
	2	69.0	62.9	71.3	65.5	2.3	2.6
R6	1	67.4	61.3	69.7	63.8	2.3	2.5
	2	68.5	62.4	70.7	64.9	2.2	2.5
R7	1	65.9	59.9	68.3	62.4	2.4	2.5
	2	67.2	61.1	69.5	63.7	2.3	2.6
R8	1	64.7	58.6	67.0	61.2	2.3	2.6
	2	65.5	59.4	67.8	62.0	2.3	2.6
R9	1	67.3	61.2	69.5	63.7	2.2	2.5
	2	68.6	62.5	70.8	65.0	2.2	2.5
	3	69.5	63.4	71.7	65.9	2.2	2.5
R10	1	66.8	60.7	69.0	63.2	2.2	2.5
	2	67.8	61.8	70.1	64.3	2.3	2.5
	3	68.7	62.6	70.9	65.1	2.2	2.5
R11	1	72.6	66.5	74.8	69.0	2.2	2.5
	2	73.0	66.9	75.2	69.4	2.2	2.5
	3	73.0	66.9	75.2	69.4	2.2	2.5

Note: F = Floor

6.3 Noise Contours

73. The predicted unmitigated day and nighttime noise contours of the year 15 (2035) for the 7.4 km road are included as **Annex II**.

6.4 Compliance with IFC Guidelines

74. As the baseline (**Table 4.4**) is already in exceedance to the Kyrgyz and IFC limit of 55 dBA and 45 dBA during day and night, respectively, the alternative is to check compliance to the IFC formula of baseline level + 3 dBA. The compliance status contours, using this IFC formulation for both day and nighttime, are included as **Annex III**.

75. Compliance maps are prepared by subtracting the baseline noise levels from the operational noise levels. Then the map separated out in two areas by taking numbers (operation minus baseline) that are >3 and <=3. The compliance status maps in **Annex III** shows:

- >3dBA (the area does not comply with IFC guideline of baseline +3 dBA and all structures coming within this area are non-compliant)
- <=3dBA (it means this area complies with IFC guideline of baseline +3 dBA and all structures coming within this area are compliant)

76. Compliance maps show that after the rehabilitation of existing road the noise levels in year 15 (2035) at the buildings complies with the IFC baseline + 3 dBA formulation. However, the noise levels are very close to the IFC guideline and could be exceeded with an increase in vehicle speed from 60 km/h to 70 km/h. In account of this, mitigation options are provided to avoid any worst case situation in the 2035 future period.

6.5 Mitigation Options

77. A set of mitigation measures was considered to establish their possible effectiveness in lowering operating period noise levels. The t measures are designed to achieve IFC +3 dBA compliance in year 2035. Following the instruction of the Client these include the following:

- Pavement modification
- Speed reduction
- Combination of pavement modification and speed reduction

6.5.1 Pavement Modification (PM)

78. Noise is directly related to the aggregate size used in the asphalt formulation. The downside is that the finer the aggregate, the greater the noise reduction but the shorter the time between asphalt resurfacing which will increase the cost of preparation and maintenance. **Table 6.6** provides the pavement options.

Table 6.6: Pavement Options

Pavement Options	Type	Reduction in Noise (approx.)
PM1	Asphalt concrete 0/11 without gritting (void % 7-8%)	- 2 dBA

PM2	Porous asphalt; pores >15% 0/11	- 4 dBA

6.5.2 Speed Reduction (SR)

79. Noise is directly related to the speed of the vehicle. The lower the speed the lower the noise level. **Table 6.7** provides the speed options.

Table 6.7: Speed Options

Speed Options	Road Section	Vehicle Speed (km/h)	Reduction in Noise (approx.)
SR1	KM8.5-KM15.9	55	- 0.5 to 0.6 dBA
SR2	KM8.5-KM15.9	50	- 1.0 to 1.3 dBA

6.5.3 Combination

80. If the noise levels still do not comply with the IFC guideline then a combination of reduced speed and modified pavement will be applied as per Client instruction. **Table 6.8** provides the combination.

Table 6.8: Combinations

Combinations	Speed Options	Pavement Options
Combination 1	SR1	PM1
Combination 2	SR1	PM2
Combination 3	SR2	PM1
Combination 4	SR2	PM2

6.6 Anomalies in Compliance

81. The section where there are structures and no area are in non-compliance is because there are higher number of lanes. This results in the reduction of noise at the dwellings by about 0.5 dBA provided that other factors remain constant. This is because it shifts the emission line at greater distance when the road width increased and reduces the impact on dwellings. The receptors basically receive noise from the two emission lines in case of dual carriageway. So, if the emission lines move to greater distance it reduces the noise. Anomaly section is from KM8.5 to KM13.0. **Figure 6.1** shows an example of anomaly section.

6.7 Conclusion

82. After the rehabilitation of existing road, i.e. and the use of the low-noise pavement formulation, the front row dwellings will follow IFC guideline of baseline + 3 dBA even in 2035. However, the predicted noise levels in 2035 will be very close to IFC guideline of baseline + 3 dBA that will be exceeded with an increase in vehicle speed from 60 km/h to 70 km/h.

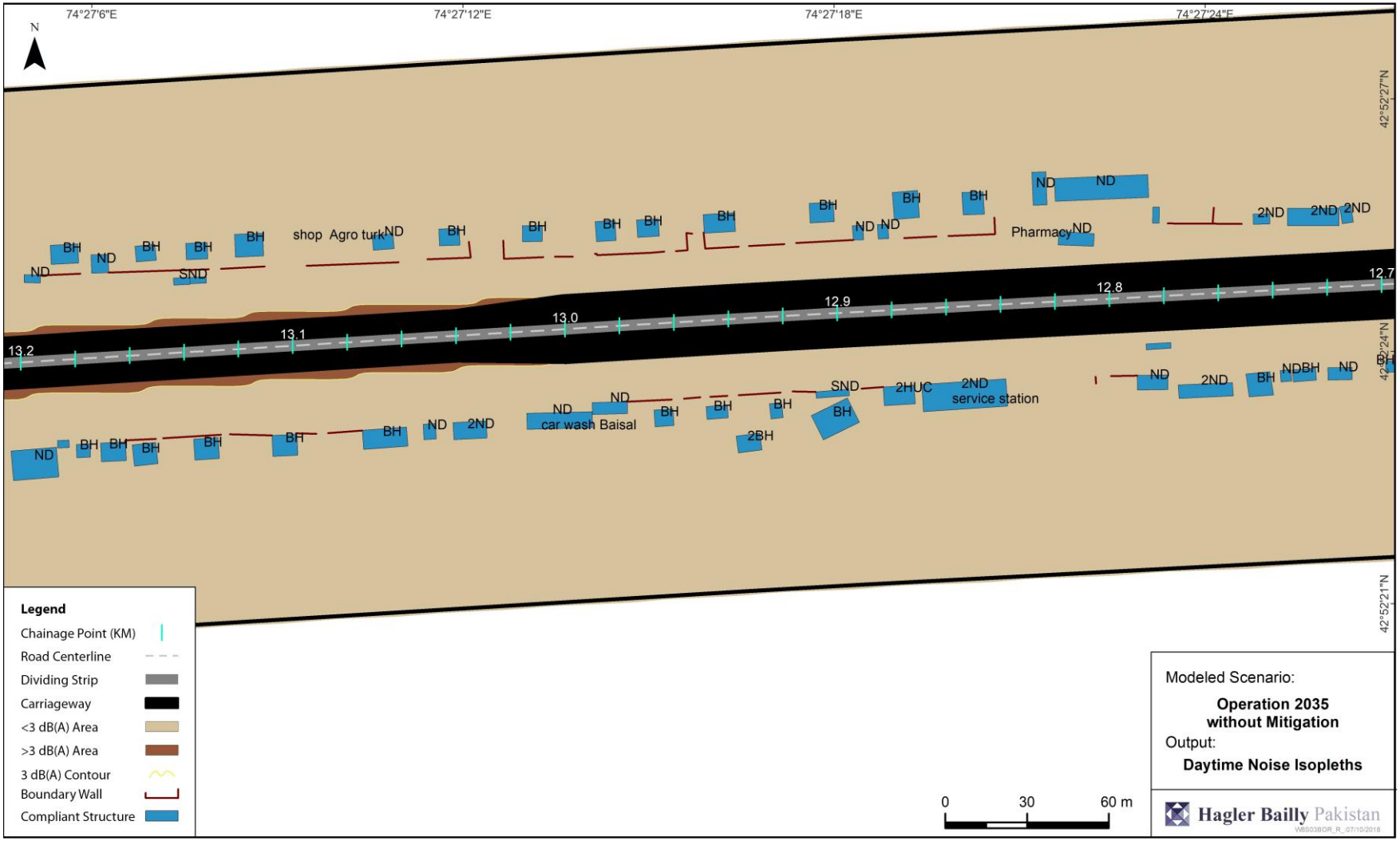


Figure 6.1: Anomaly Section - Example

7. Recommendations

83. Construction should be avoided during nighttime as the nighttime noise levels during on-going construction work exceed the IFC guideline of baseline + 3 dBA by 5.0 dBA and 8.9 dBA, during Typical and Extreme Configurations, respectively. If it is inevitable then “Typical Configuration” should be the prevailing configuration with the suggested mitigation measures in-place.

84. PM1 surface (Asphalt concrete 0/11 without gritting - void % 7-8%) should be applied as the predicted noise levels in 2035 with the proposed pavement (asphalt concrete) should stay within the IFC guideline of baseline + 3 dBA. However, this limit will be exceeded with an increase in vehicle speed from 60 km/h to 70 km/h.

85. Shifting to low-noise pavement is the preferred option as compared to reduction of vehicle speeds as drivers may over speed even after application of speed limits resulting in noise levels exceeding the standards.

86. Ideally, the PM1 asphalt formulation and enforcement of the 60 km/h speed limit will ensure that the IFC guideline of -baseline +3 dBA standards are maintained along this stretch of road.

87. These mitigation measures are the same actions as proposed for KM15.9 through KM61 of the Bishkek-Kara Balta Road.