INITIAL ENVIRONMENTAL EXAMINATION

Project Number: 45169
Loan Number: 3056/Grant Number 0366-KGZ
Updated in 2015, 2017 and 2018

CAREC Transport Corridor 3 (Bishkek – Osh Road) Improvement Project, Phase 4 Engineering and construction supervision

This Initial Environmental Examination Report was prepared for the Ministry of Transport and Communications of the Kyrgyz Republic and updated in 2015 and 2018 by EPTISA Servicios De Ingenieria S.L./Eptisa Muhendislik/RAM Engineering in accordance with the Kyrgyz Republic Environmental Protection Legislation and ADB requirements. It is a document of the Borrower.

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ABBREVIATIONS

ADB	-	Asian Development Bank
AP	-	Affected Person
CAREC	-	Central Asia Regional Economic Cooperation
CEMWP	-	Construction Environmental Management Workplan
CSC	-	Construction Supervision Consultant
dBA	-	Unit to express the relative loudness of sounds in air as perceived by the human ear.
EA	-	Executing Agency
EMP	-	Environmental Management Plan
EMR	-	Environmental Monitoring Report (by CSC to IPIG and ADB)
GRG	-	Grievance Redress Group
GRM		Grievance Redress Mechanism
HIV	-	Human Immune Deficiency Virus
IEE	-	Initial Environmental Examination
IPIG	-	Investment Projects Implementation Group
KGS	-	Kyrgyz Suum
KR	-	Kyrgyz Republic
MOF	-	Ministry of Finance
MOTR	-	Ministry of Transport and Roads
MPL	-	Maximum Permissible level
MPC	-	Maximum Permissible concentration
NGO	-	Non-Governmental Organization
PAP	-	Project-Affected Person
PPTA	-	Project Preparatory Technical Assistance
RAP	-	Resettlement Action Plan
RoW	-	Right-of-Way
SAEPF	-	State Agency of Environment Protection and Forestry
SEE	-	State Agency for Environmental Expertise
SHZ	-	Sanitary Hygienic Zone
SSEMP	-	Site Specific Environmental Management Plan
TOR	-	Terms of Reference

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 (Bishkek-Osh) Improvement Project. This Initial Environmental Examination (IEE) has been prepared as part of the feasibility study for the project. The study covers section Bishkek to Kara Balta (45.1 km).

2. The proposed project will improve connectivity and access to markets in Kyrgyz Republic. The outcome of the project will be efficient movement of freight and passenger traffic along the Bishkek-Osh road. According to the categorization of ADB Safeguard Policy Statement, the project belongs to category “B”, hence requiring the preparation of an IEE report. According to the legislation of Kyrgyz Republic the project requires State Environmental Expertise (SEE).

3. This report includes background information on Kyrgyz Republic, relevant legislation and the project area. It 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. Most impacts due to the work will be confined to the construction stage of the Project and will focus in noise, vibration, air pollution, traffic management and project-related occupational health and safety issues. Since the traffic forecasts have not shown any traffic diversion to the upgraded highway, natural traffic volume increases of between 5 and 7% per years will result a continued increase in unacceptably high noise levels which are to be mitigated through speed control and the installation of noise attenuating pavement. The speed reduction to 60 kph and installation of noise attenuating pavement is expected to reduce noise levels by at least 3.3 dBA of baseline modelled measurements.

5. The danger of increased pedestrian vs. vehicle accidents will be mitigated by providing better and more frequent at-grade pedestrian crossing facilities.

6. The specific impacts identified during the IEE work were: (i) noise (ii) air pollution, (iii) vibration, which is especially of high significance within the settlements alongside the Project road and where sensitive receptors such as houses, schools, hospitals mosques or historically important features are located (iv) impacts on water courses and rivers due to bridge and culvert construction (v) aggregate mining at borrow sites; (vi) soil, vegetation and tree loss; (vii) operation of asphalt plant and aggregate processing facilities (vii) occupational health and safety infractions by the contractor.

7. Mitigation measures for each of the impacts have been developed and incorporated into the Environmental Management Plan (EMP) and followed up with a Construction Environmental Management Workplan, supported by a number of Site Specific Environmental Management Plan (SEMP) addressing work specific areas such as dust control, noise monitoring, vibration monitoring, waste management, borrow site management, among others.

8. In addition the contractor will have to prepare and submit to IPIG and to the Construction Supervision Consultant monthly monitoring checklists based on the EMP and the Construction Environmental Management Workplan.

2017-2018 Update

9. In May 2017, prior to the start of construction, air, noise and water quality testing was completed to update baseline conditions. The full analysis of this dataset is presented in Annex 2 of this IEE. Findings indicated that noise had not changed significantly from 2015, air quality had generally improved and water quality had not changed significantly as well. Given the large variation in readings for air quality measurements in particular, further construction period monitoring will be undertaken monthly and quarterly for at least through 2018, recording noise, air and water quality at the same locations where preconstruction sampling took place. In early 2018 the CSC and IPIG re-examined the field survey program and adjusted it to address new areas of concern, e.g. the temporary access road at Km 17 of the project road.

10. The Construction Environmental Management Workplan (CEMWP), essentially a consolidation and elaboration of the IEE's EMP, addressing both mitigation and monitoring actions during the construction period and actions needed by all stakeholders, was completed in June 2017. The contractor is using it and a number of compliance checklist reports have already been submitted. The consultant provided two training sessions to the contractor and IPIG on the implementation of the CEMWP and the use of the 15 Best Practice (SSEMP) Guidelines.

11. Due to the large number of trees to be cut (4,793), the contractor has also completed tree cutting and tree replanting plans for all road sections where tree cutting is necessary.

12. Further, the disposal of waste asphalt taken from >45 km or highway will be managed by placement on rural roads of the 200 roads identified by local authorities 88 will receive the material first and if this proves successful other roads will be added, since a large volume of waste asphalt will remain even after the work on the 88 roads is completed. The contractor is undertaking this work in full compliance with revised SSEMP Annex-7 attached to this updated IEE, including specific consultation and oversight by local officials when waste asphalt is being placed.

13. In addition to the CEMWP, which contains comprehensive details for all environmental mitigation and monitoring requirements, the following SSEMP were prepared:

- Annex 1 Emergency Management Plan
- Annex 2 Grievance Redress Mechanism
- Annex 3 Plan for Safety, Health And Hygiene
- Annex 4 Management Plan for the Life of the Construction Camp
- Annex 5 Waste Management Plan
- Annex 6 Noise Management Plan
- Annex 7 Old Asphalt Management Plan (Updated and included with this IEE)
- Annex 8 Water Quality Management Plan
- Annex 9 Air Quality Management Plan
- Annex 10 Tree Management Plan for Sections 1-4 (Separate Volume due to size)

- Annex 11 Dust Suppression Plan
- Annex 12 Land Protection Management Plan
- Annex 13 Environmental Protection Plan for the Construction and Reconstruction of Bridges
- Annex 14 Borrow Pit Management Plan

14. With the exception of the updated SSEMP Annexes 4 and 7 attached to this IEE, the other guidelines were compiled in two separate volumes within the CEMWP, have been translated to Russian, and are being implemented by the contractor. These SEMPs (including the original Annex 4) were approved by ADB in advance of the final IEE.

15. As part of the consultant's work and until the contractor is fully in compliance with all elements of the CEMWP, a weekly or fortnightly monitoring report will be prepared by EPTISA. Since mid July 2017, 10 such reports have been completed, including both text and photo record of the contractor's activities. They have already been used to issue a number of non-compliance notices to which the contractor has responded.

16. A noise modeling study to estimate construction period and operating period noise levels at a number of sensitive receptors as well as the entire front row of structures along the 45km long road was completed in April 2018. In addition to this report, noise testing will continue in the field at all stations sampled from 2013-2017 and with a few additional stations. Baseline noise levels along the road were estimated to be 13 dBA to 17 dBA above Kyrgyz and IFC standards for day and night conditions respectively. The modellers tested the construction period 80 and 60 kph speed limit scenarios, as well as the 60kph speed and noise attenuating pavement scenario for the operating period. Increases in noise due to construction ranged from 1.5 to 5.2 dBA for the typical equipment deployment (90% of the time) scenario and up to 8.7 dBA for the extreme equipment deployment, expected to occur only 10% of the time.

17. Operating period noise projections showed that without mitigation noise levels along much of the road are in compliance with the IFC's +3 dBA standard. Of the 4,379 structures exposed four were non compliant during day conditions and 135 during the night. The non-compliant conditions should be fully mitigated through MOTR's use of noise attenuating pavement and enhanced by maintaining operating period speed limits at or below 60 km/h.

18. In response to complaints received in 2017 by 24 roadside residents that the vibratory compactor operation was resulting in cosmetic and structural damage to foundations and walls of dwellings close to the road edge, a vibration study was completed (MRCL, 2018). No and higher frequency subgrade vibration and trenching between the work and dwellings were the three mitigation measures proposed since the use of low frequency compaction would lead to more serious damage, not easily repaired. Mapping suggested that one or a combination of measures could have been employed along all sections where vibratory compaction was needed, therefore mitigating this impact. After a further review of this approach by IPIG, the approach chosen was to eliminate the use of all vibratory compaction thus eliminating the construction-related vibration impact. Therefore, vibration is no longer a mitigation issue.

19. Recognizing the serious issue of severance and access the road designers added 95 new marked at-grade crossings, 12 new signalled crossings and six new pedestrian underpasses, plus rehabilitation of four existing but presently unusable structures.

I. INTRODUCTION

A. Background

1. In 2013 a feasibility study for the CAREC Corridor 3 (Bishkek-Osh Road) Improvement Project, Phase 4 (45169-002) was prepared. In late 2014 the construction supervision consultant EPTISA Servicios De Ingenieria S.L./Eptisa Muhendislik/RAM Engineering was selected to supervise the construction of this section of the road. As part of this assignment the consultant is required to revise and update the IEE and submit it to the MOTR and ADB for review and approval. A State Environmental Expertise in the State Agency for Environmental Protection and Forestry under the Government of the Kyrgyz Republic is required.

2. 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.

3. Bishkek, the capital of the Kyrgyz Republic, is the country's political and economic hub with a dense population of 840,000. The largest city after Bishkek is Osh (population 250,000), located in the Fergana valley in the south, the country's major agricultural area. 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.

4. The Bishkek-Osh road represents about one fourth of the core 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 provinces 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.

5. 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.

6. The proposed project will improve the national and regional connectivity by rehabilitating 45.1 km of crucial road section between Bishkek and Osh. The proposed project is consistent with the government's priority in upgrading key corridors as stated in its draft Medium Term Development Program (2012–2014) and is included in ADB's draft Country Operations Business Plan (2012–2014) for the Kyrgyz Republic.

7. 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 (Bishkek-Osh) Improvement Project, Phase 4. A feasibility study suitable for ADB financing is required for the loan and/or grant. An Initial Environmental Examination (IEE) has been prepared as part of the feasibility study, which is now being updated as part of implementation stage. The study covers the road section Bishkek to Kara Balta (45.1km).

8. 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) 45.1 km of rehabilitated road from Bishkek to Kara Balta,

(ii) strengthened road asset management system,

(iii) improved road safety.

9. Environmental impacts of the Bishkek –Kara Balta road rehabilitation will take place along the existing RoW. 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 the Project road and where high risk dwellings and sensitive receptors such as schools, hospitals mosques are located;

(ii) impacts on water courses and rivers;

(iii) impacts from aggregate sourcing at borrow sites and establishment of 1 new site;

(iv) impacts on soil and vegetation, including tree plantations alongside the Project road due to site clearance activities;

(v) impacts from bridge rehabilitation/reconstruction;

(vi) Impacts from asphalt plant and aggregate crushers; and,

(vii) impacts from contractor's working camps.

10. Impacts have been divided into those likely to take place during the design phase, construction phase, and operation phase, and are described in the chapter "Environmental Impacts and Mitigation Measures" and in the Environmental Management Plan (EMP).

11. The Bishkek – Kara Balta road section is located between km 15.9 and km 61 of the Bishkek – Osh Road. The section starts in Sokuluk rayon at road km 15.9. At the beginning the road has a 6-lane configuration , then reduces to a 4-lane configuration until km 21. 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 to the outskirts of Kara Balta town, passing through a number of settlements interspersed by agricultural fields first with a 3-lane configuration of carriageway, than changing to 2-lanes. The paved width is 8 to 12 m and the shoulder width is 1.5 to 3.0 m. At km 61 the Bishkek-Osh Road turns south at a roundabout, marking the end of the project road section. The terrain for the entire 45 km can be classified as flat with altitudes ranging from 750 m to 800m.

12. Including the three towns crossed by the road, land use along the Bishkek - Kara Balta road section is mainly and urban agricultural mix. Cultivated crops are mainly wheat, feed and technical crops, different kinds of vegetables like potatoes, peppers, carrots, watermelon and eggplant and fruit plantations like apples and apricots.

13. The first field surveys for the environmental investigations were conducted in November 2012, and over the winter work focused 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. Extensive site surveys on the physical and biological environment were conducted in March and April 2013. Based on field observations and surveys, environmental impacts were identified and suitable mitigation measures prepared. The entire project was re-examined in 2014 and additional field surveys, as recommended by ADB, were

completed. Based on this finding and further field inspections the IEE was fully revised, submitted to ADB and approved.

14. A subset of the sensitive receptors was identified alongside the Project road and baseline measurements were conducted. Public consultation meetings were conducted in Voenno_Antonovka village, Sokuluk city, Belovodskye village and Poltavka village. Minutes were taken and are attached to the report.

I. 2017-18 Update

15. A new set of survey and studies was completed in 2017 addressing air quality, noise, water quality and vibration. The surveys provided updates to existing conditions and special modelling studies were undertaken for better define noise and vibration impacts and appropriate mitigation measures.

16. A further set of field surveys in being completed for the 2018 construction season and will be reported on in the semi-annual monitoring report.

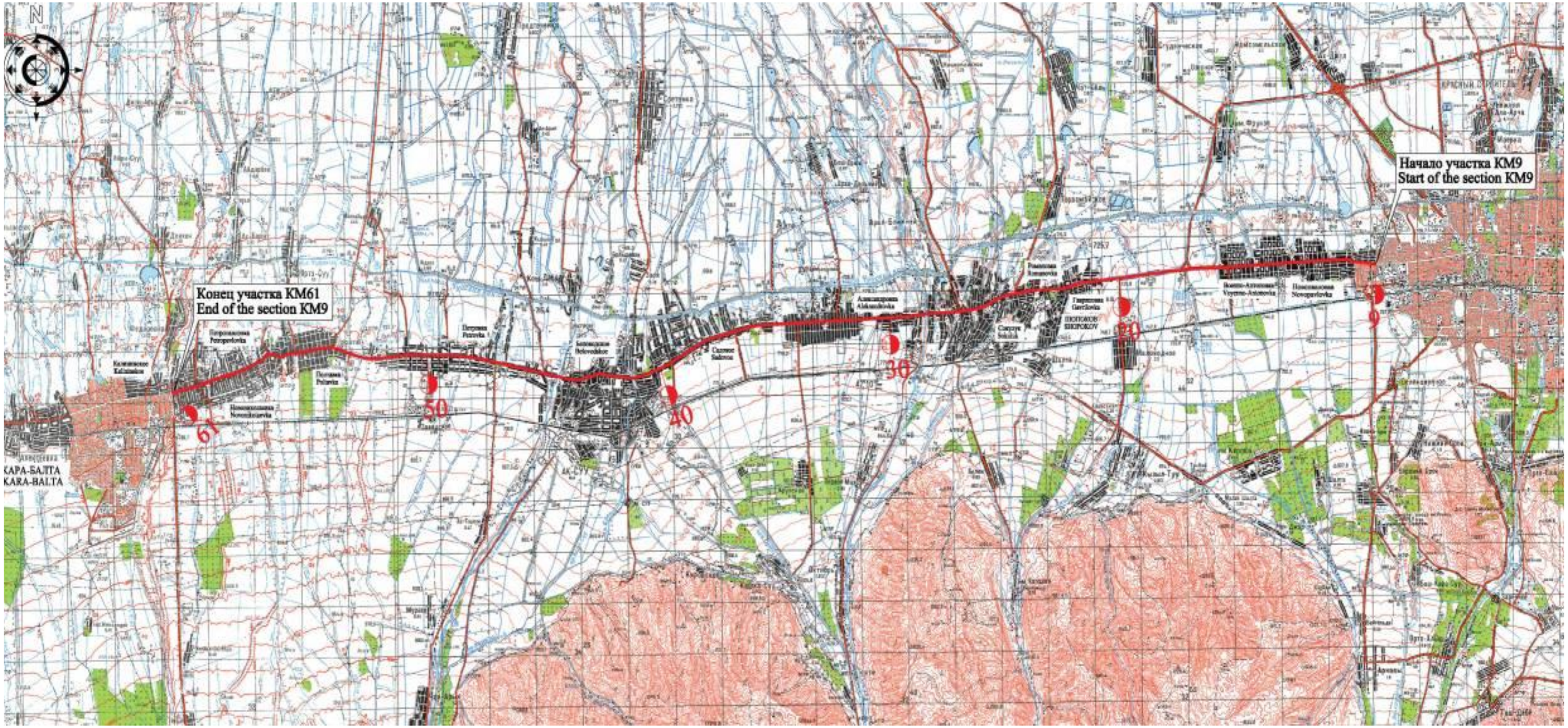

Figure 1. Bishkek-Kara Balta road section: km 9-61 (the original length)

B. Environmental Protection Legislation

I. Kyrgyz Republic

17. Environmental impact of the Bishkek – Osh Rehabilitation Project is regulated by a number of environmental legislative acts of the Kyrgyz Republic (Table 1).

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

#	Legislation	Number & Year of adoption	Purpose/content
Main laws on environmental protection			
1	The Constitution of the Kyrgyz 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	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.
Legislation on Land Acquisition			
14	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).
15	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.
16	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.
17	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.
18	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)
19	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			
20	The Law "On protection and use of historical and cultural	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

	heritage"		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.

II. 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.

18. 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.

III. ADB Safeguards

19. 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. An initial environmental examination ia prepared.
- 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

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

management system, unless all subprojects will result in insignificant impacts.

20. Public consultation meetings on social and environmental issues were carried in June 2013 in Voenno Antonovka village, Sokuluk city, Belovodskoe village and Poltavka village. Minutes were taken and are attached to this report as Annex 1. The 2013 IEE report was submitted to the State Agency of Environmental Protection and Forestry of the Kyrgyz Republic received the SEE approval, and sign off by ADB. Few setions of the IEE was revised again in 2015

C. Environmental Standards

21. The following environmental standards are applied to the Project.

1. Air quality

Table 2.Kyrgyz ambient air quality standards

Pollutants	**Maximum permissible concentration (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 tetraethyl)	-	0.0003
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

Table 3. Kyrgyz outdoor noise standards (dB)

Description of activity/category	Leq		Lmax	
	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	
Rest areas at the territories of micro-districts and building estates, 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”.

22. The ADB and the specialist noise consultant established that the IFC-3dBA standard should be applied for all future noise projections. This standard says that non-compliance occurs when the future projections exceed the baseline condition levels by more than 3 dBA.

3. Vibration

23. In 2013 vibration measurements were made and it was determined, although difficult to assess due to the unusual units of measure used, that vibration along the

roadside was unusually high, pointing to the movement of large trucks, heavy vehicles and buses as the likely cause (Table 21).

3. Surface water

24. Standards are shown in Table 4, which are based on the Kyrgyz Water Law of 1994.

Table 4. Surface Water quality standards[2]

	Standard
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

Source: Water Law of the Kyrgyz Republic, 1995

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

II. DESCRIPTION OF THE PROJECT

A. Overview

25. 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 at rehabilitating 45.1 km of road between Bishkek and Kara Balta, and to (i) provide safe and comfortable riding conditions to all road users, be they motorists, 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); and (iii) to comply with the Pavement Standards and other relevant State Road Authorities' Guidelines and/or Standards as they relate to Class I roads.

26. Conditions of the existing road are not up to KR Class IA-B standards (Table 6) in that road markings are few, traffic signs are insufficient and sometimes poorly located, and road surfaces and shoulders are usually poorly maintained. Guardrails on high embankments are only partly installed 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.

B. Type and Category of Project

27. The Bishkek to Kara Balta road work will rehabilitate around 45.1 km of the Bishkek to Osh transport corridor. The project is categorized as Category "B" , requiring an IEE.

C. Need for Project

28. The Bishkek-Kara Balta road section, the critical link of the Bishkek-to-Osh road is one of the most important transport corridors in Kyrgyzstan. Traffic, especially heavy vehicle volume is high and increasing, adding to the already daily traffic jams. Traffic safety and the problem of severe rutting due to high air temperatures and a poor selection of asphalt binders, as well as pavement undulation signalling insufficient bearing capacity of the carriageway, underscores the urgent need for this project to be implemented.

D. Analysis of Alternatives

29. Given the size of the country and the very limited options available, the instruction in the project ToR stated that the road rehabilitation was the only solution to the road problem, therefore not allowing further analysis.

I. Alternative Solutions

30. The Bishkek-Kara Balta section of national highway is extensively used with traffic volumes as high as >45,000 vehicles per 24hr period. The road is poorly marked, with very limited shoulders (most are gravel and dangerous), has a very rough surface and has the highest accident rates in the country.

31. Due to land use, and land occupancy issues in the road corridor, a new road alignment was not considered, as this would trigger massive resettlement.

32. 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' railway which 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. Development projects on this scale would require huge investment and would likely be prohibitive for the Kyrgyz economy. Therefore massive costs for Kyrgyzstan make these alternatives less attractive for now.

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.

33. KR planners therefore are planning to implement this full resurfacing of the national highway is the preferred solution.

II. Alternative Designs

34. Alternative designs have focused on at least 12 variables, addressing all aspects of the work. These were carefully assessed in the Feasibility Study. The 12 key factors are:

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

35. 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. This work was completed on early 2017 and a design was approved and contract to undertake the work was implemented and construction was started in May 2017. Ground vibration was not considered in the early design planning.

36. 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 road design specifications of MOTR. Further, the construction environmental management plan prepared by the CSC and the contractor, requiring a major replanting program of 5-7 year old nursery trees, specified that replanting needed to start in a section as soon as plantings would be disturbed/damaged by construction. In addition, special tree removal and replanting plans have been prepared for each of the four road sub-sections under construction in 2017 and another set for the 2018 period . Two of four 2018 plan has been approved and tree removal is proceeding.

III. The Preferred Alternative

37. The preferred, alternative will see the construction completed in 3 years, all work undertaken within the existing road RoW and as much of the more than 1 million m^3 of asphalt concrete to be removed from the >45.1 km of a 4-6 lane highway recycled and/or 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 many thousands of tons of 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. That being said, the road and sidewalk design calls for the removal of 4,793 trees.

E. Location

38. The Bishkek – Kara Balta road section is located between km 15.9 and km 61 of the Bishkek – Osh Road (Figure 2). The section starts in Sokuluk rayon at road km 15.9[3]. At the beginning the road has a 6-lane configuration, which turns to a 4-lane configuration of the carriageway until km 21. The existing pavement is asphalt concrete and the paved width is between 15 and 20 m and a median of 2 – 4 m. Shoulder width ranges from 1.5 to 3.0 m. The Section proceeds westward to the outskirts of Kara Balta, passing through a number of smaller settlements interspersed by agricultural fields with a 3-lane configuration of carriageway, which changing to 2-lanes. The paved width is 8 to 12 m and the shoulder width is 1.5 to 3.0 m. The villages along the road are merging into a relatively continuous ribbon along the roadway. At km 61 the Bishkek-Osh Road turns south at a roundabout, which marks the end of the road section. The terrain for entire sections can be classified as flat with altitudes ranging from 750 m to 800m.

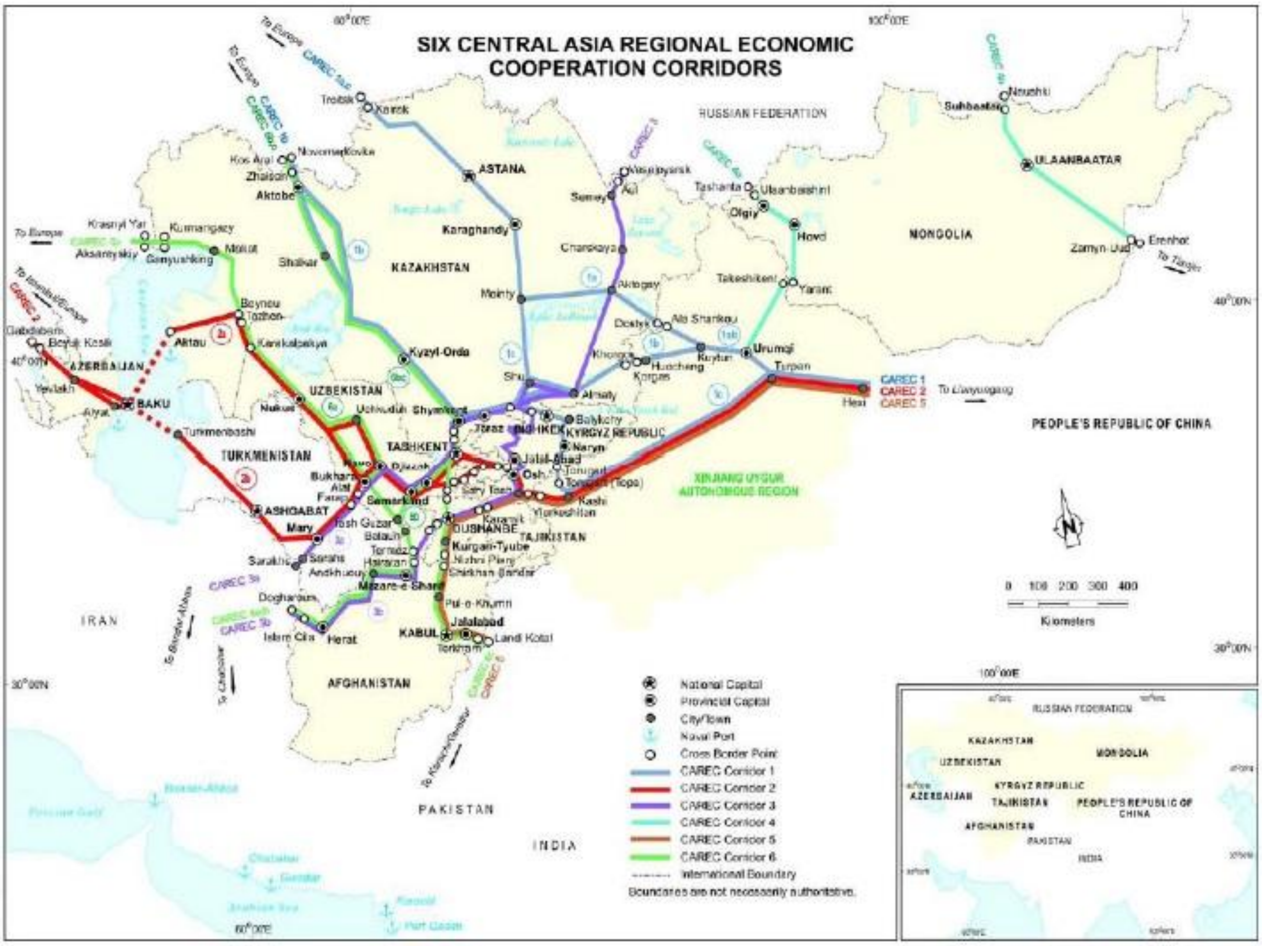

Figure 2: Central-Asian Regional Economic Cooperation Corridors

F. Size or Magnitude of Operation

39. The Project involves rehabilitation of 45.1 km road length of the Bishkek – Osh road. The construction works will be implemented mainly within the 60-62 m wide RoW of the existing road, 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 crusher, establishment of contractor's worker camps and storage sites, etc.

[3] Prior to 2017 the project road began at km 9.1 but in early 2017 the starting point was moved to Km 15.9 making the project road 45.1 km long and eliminating three sensitive receptor sites. This has caused some confusion since there were 16 sensitive sites receptors for which air and noise quality data had been collected since 2013. These data remain in the IEE as they provide useful time-series information.

40. According to the terms of reference, the pavement for the road will be designed for an initial design life of 10 years with overlay options for 15 and 20 years design life. The use of noise attenuating pavement will reduce the design life somewhat; the exact amount depending on the exact asphalt concrete formulation.

41. Construction started in 2017 and was implemented simultaneously at a number road sections where resettlement was not an issue. Steps undertaken were demarcation of trees to be cut, clearing and grubbing followed by reconstruction of all culverts and bridges, in parallel with the removal of the old asphalt and placement of subgrade materials as a part of the construction of new highway lanes. This work is continuing in more less the same sequence. Two work camps were built in late 2017, then finished and occupied in April 2018. At the same time the aggregate processing, concrete batch and asphalt batch plants were completed and erected in the Ak Suu 2 borrow area.

42. Construction on three bridges was started in 2017 with the Jelamysh bridge work starting in late 2017. The work involved reconstructing one half of the bridge first, and then the other, thus avoid having to build detours. Given that the rivers are dry for 6-8 months of the year, work was carried out during no-water conditions, whenever possible. The concrete bridge structure was mostly poured-in-place work, with the exception of some girders, which were prefabricated.

43. As of September 2018 the Jelymish River bridge was complete and work is ongoing on the Sokuluk and Ak Suu bridges.

G. Work Camps

44. The contractor offices and two work camps are presently in operation. The contractor's and CSC's field office is located in Sokuluk village, and houses around 50 people, with sleeping and eating quarters. A small construction workers camp also operates in Belavodsk at around km 28 of the roadway and accommodates around 12 workers. The third and largest camp is at AkSuu within the materials processing facility boundary. At present around 40 people occupy this facility.

H. Traffic Volume

45. Traffic growth forecasts have been developed with regard to the existing traffic volumes on the project road, as revealed by the traffic surveys (Table 5), and anticipated national and regional economic development.

Table 5. Traffic count. Vehicle totals for April 2015, June 2017 (total vehicles per day)

Location: Bishkek, km.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	
	June 2017	24 hr. Traffic Count		49,335
Location: Sadovoe, km.35	Date: 08 April, 2015, Wednesday	Time: from 07am to07am (24 hours)		Total
Direction: Bishkek to Kara-Balta			8868	17,327
Direction: Kara-Balta to Bishkek			8459	
	June 2017	24 hr. Traffic Count		19,919
Location: Poltavka, km.53	Date: 09 April, 2015, Thursday	Time: from 07am to07am (24 hours)		Total

Location: Bishkek, km.9	Date: 07 April, 2015, Tuesday	Time: from 00am to00am (24 hours)		Total
Direction: Bishkek to Kara-Balta			5435	10602
Direction: Kara-Balta to Bishkek			5167	
	June 2017	24 hr. Traffic Count		10,632

Source: EPTISA datasets 2015 and 2017

46. The natural traffic growth was estimated by Kock's and EPTISA at approximately 7% per year for passengers and 4% per year for truck traffic through 2019 (the projected end of construction and then 4%/year for both, passenger vehicles and trucks during the operating period.

47. From the traffic observations, the first part of the Bishkek to Kara Balta road is classified as class IA and remaining road section is class II (Table 6).

Table 6. Road classifications in the Kyrgyz Republic

Road Class	Volume to Capacity Ratio	Level of Service	Design Traffic Volume		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	6,000 – 14,000	3,000 – 7,000	Highways of international and national importance (not covered by category IA and IB)
III	0.40 – 0.60	C: medium	2,000 – 6,000	1,000 – 3,000	Highways of international, national and importance (not covered by category IA, IB and II)
IV	0.60 – 0.80	D: low	200 – 2,000	100 – 1,000	Provincial and 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)

I. Proposed Schedule for Implementation

48. In 2015 the schedule for the construction activities was at a preliminary planning stage. The bid documents were prepared in 2016, at which time environmental clauses in line with the EMP were integrated into the contract specifications. The proposal was called in 2016 and construction began in May 2017. Given the late start the construction may extend beyond the target completion date by as much as one year or more namely well into 2020.

J. Detail of the Project

49. The project is planned to:

(i) provide safe and comfortable riding conditions to all road users, being 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.

50. Using the field surveys and traffic observations in early 2015 and additional data collected in 2016 the preferred option was identified and was based principally on where to apply (i) non-structural overlay, (ii) structural overlay, and (iii) reconstruction with/without lane widening.

51. Key design details are as follows:

- RoW width is approximately 31m in either side of the road centreline
- 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;
- Longitudinal gradients in wavy terrain are up to 5-7%;
- The carriageway cross fall on straight sections has been taken as 2% and shoulder slope has been taken as 4%.
- Two lanes in both directions, plus paved shoulders and a median
- 95 new marked at-grade crossings,
- 12 new signalled crossings and
- two underground pedestrian crossings (plus the rehabilitating the 4 existing underpasses.

52. During the 2013 and 2015 surveys KOCK'S and EPTISA respectively found that culverts were missing in many areas, yet they are specified in the technical certificate of the road provided by the Client.

53. Most of the bridges and culverts are not properly constructed and maintained. Construction materials and scaffolding material can still be found in concrete surfaces. The rubber pad/bitumen sheet placed to support the beams and slab of bridges are worn out and do not exists in many places. The existing waterway and side slopes of abutment haven't been cleaned from vegetation and debris. Bridges are at the end of their economic life. As of the start of the 2017 construction season, nearly all the 204 culverts are being replaced due to not only to problems with design and workmanship, but also since the additional two lanes will require culvert extension, which most often will mean total replacement.

54. The three river bridges and three-canal crossing are in poor condition and need total reconstruction. Both the bridge and culvert repair/replacement work will have environmental impacts that need to be mitigated. In addition to the mitigation tasks defined in the Environmental Management Plan, a special guideline on bridge and culvert construction (SSEMP Annex 13) has been prepared for use by the contractor.

K. General Environmental Profile

55. There are only a few environmentally significant structures along the project road section, namely Sokuluk (chainage 28.3 km) and the Ak-Suu (chainage 44.65 km) rivers and several smaller seasonal watercourses and irrigation canals which the road crosses. There are also roadside trees, about which details are provided later in this IEE.

56. Of the six borrow areas to be used to provide aggregate; five are operating quarries located between 2 and 7 km of the highway (Figure 7). In many cases the access roads to the borrow areas are unpaved and go through semi-residential areas, which will result in serious dust problems during the long dry season. Borrow site No. 1 will be new and located about 11 km south of the highway in the lower foothills (Figure 7)

57. Aggregate processing, asphalt mixing and concrete batch plants have been established at a large site south of Ak Suu in the old floodplain of the Ak Suu River.

58. Sixteen locally important sensitive receptors (SRs) were identified during the 2013 field investigation and verified during the 2015 survey and again in 2017 (Figure 3). This approach to addressing air quality, noise and vibration concerns by focusing on sensitive receptors was agreed to with ADB in 2013, 2015 and again in 2017. These SRs are mostly schools hospitals, residential areas and businesses listed below, and are addressed in more detail in Table 15. Alignment Sheets Starting from Bishkek side, these sites are:

1. Novopavlovka village (school, No. 2)-*deleted when the road length was reduced-but data collection continued*
2. Novopavlovka village (market)- *deleted when the road length was reduced-but data collection continued*
3. Voenno-Antonovka village (school, no number)- *deleted when the road length but data collection continued - reduced*
4. Voenno-Antonovka village (mosque)
5. Gavrilovka village (school, no number)
6. Shopokov city (school, No.2
7. Sokuluk village (market)
8. Sokuluk village (school No. 2)
9. Sokuluk village (dwelling houses)
10. Alexandrovka village (school No. 3)
11. Belovodskoe village (market)
12. Belovodskoe village (mosque)
13. Petrovka village (dwelling houses)
14. Poltavka village (school, no number)
15. Petropavlovka village (school, no number)
16. Novonikolaevka village (school, no number)

59. In late 2016 MOTR decided to shorten the project alignment and move the start to Km. 15.9, resulting in the removal of Sensitive Receptors 1,2 and 3. At IPIG's request data collection at these stations was maintained.

60. With the addition of the vibration monitoring, all high risk dwellings within the 16m distance of the road edge were added as sensitive structures, susceptible to noise impacts and vibration damage.

61. The focus on the 16 then 13 sensitive receptors in no way suggests that the IEE was not including the effects on the entire population and resources along the road. The sensitive receptors were used to highlight worst-case conditions.

62. Due to the construction of a 2 km–long temporary road at km 17 of the project road, used to haul construction materials from the new Jelamysh borrow site to the construction site, local authorities indicated closed the that heavy loads would damage the newly repaired road. To monitor this issue an additional air quality and noise testing station was established and monitoring will continue to the end of the construction period, unless the use of the road is discontinued.

L. 200 Roads to Receive Waste Asphalt

In an effort to find a more environmentally acceptable approach to the handling and disposal of thousands of tons of waste asphalt removed from the 45 km or highway, the contractor agreed with local authorities and IPIG to crush the material and place it on roads identified by local authorities. Given the large volume of material 200 roads were initially identified by local authorities, then later reduced to 88. A prioritized list of 11 roads was developed, and by September 2018, these roads had received the crushed asphalt. Paragraph 222 provides additional details. And Addendum to Annex 7 address the impacts and mitigation measures to be applied in detail.

The contractor has established an fully acceptable approach to the disposal involving 4 steps:

1. consultation with local authorities on where to place the waste asphalt
2. inspection of the road and identifying any sensitive issues witih local authorities prior to placement including confirmation of public ownership;
3. placement of waste asphalt with local engineer present to ensure proper placement
4. On site crushing to acceptable material size using heavy equipment and with inspection by local authority

Using this approach there is little chance of problems occurring. Table **37**
Provides basic details on the candidate roads and detailed mapping will be provided in the 06-12, 2018 EMR.

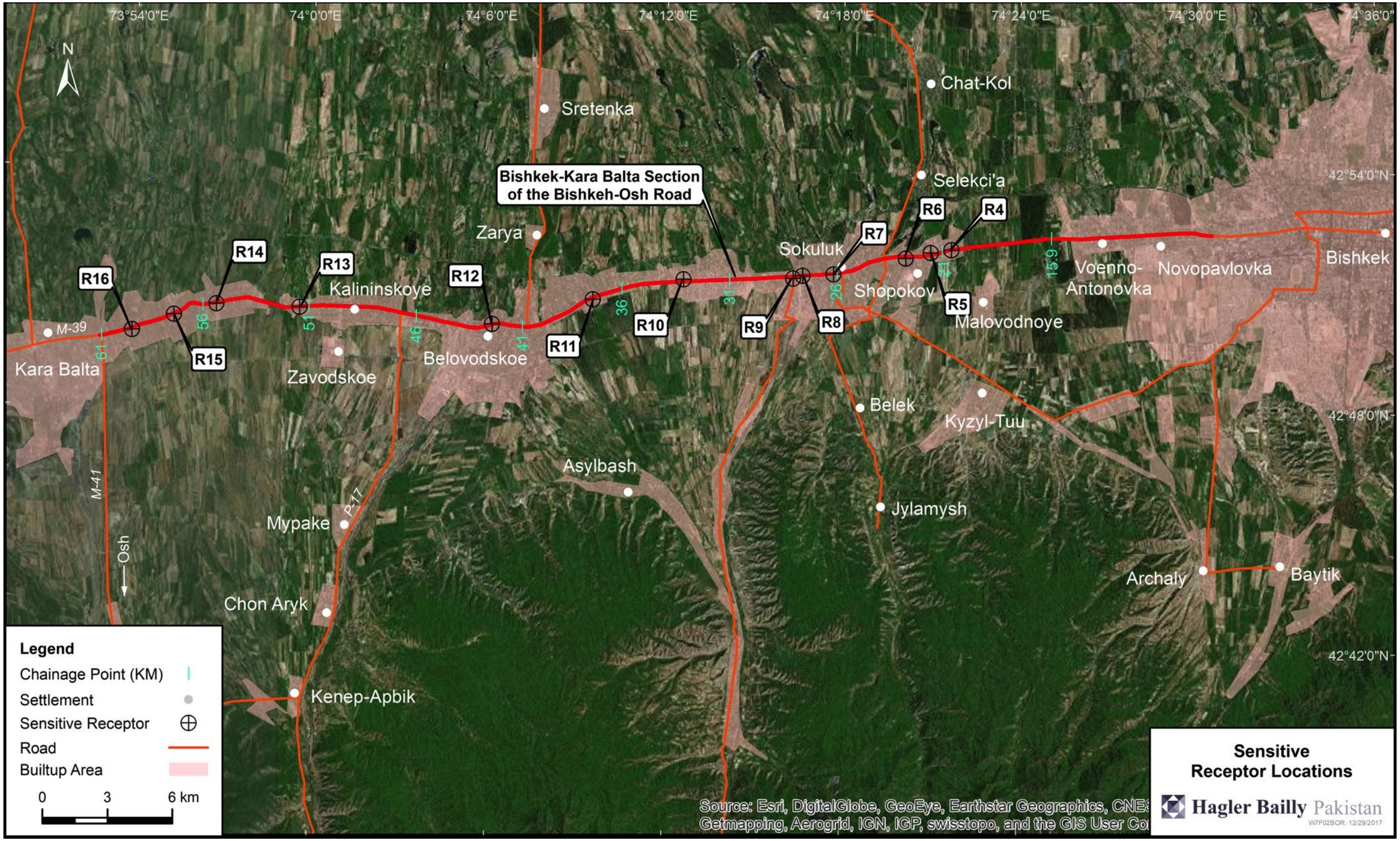

Figure 3. Location of sensitive features along the road alignment

III. DESCRIPTION OF THE ENVIRONMENT

A. Physical Resources in Project Area

I. Topography

63. 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.

64. 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.

65. To provide a reliable 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). The survey included topographical details like existing roads, layout, drainage structures, buildings etc.

II. Soil and Geological Characteristics

66. The territory of Kyrgyz Republic is mountainous and occupies the western part of the Tien Shan range and a small part of the North Pamir.

67. The road section from Bishkek to Kara-Balta is predominantly flat and not subject to land or rockslides. It is within the Seismic Risk Zone No. 9. The section falls within a zone of landslide dispersion and accumulation with virtually no landslide risk.

68. Soil erosion is a major environmental concern 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.

69. Soils of the road section from Bishkek to Kara-Balta are classified as 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.

III. The Borrow Sites

70. **The Jelamysh borrow site**- The area given for borrow pit operation at the “Jelamysh” site is 64,500 m^2 (see Special Annex 14). This is the only new totally undeveloped site. The turn off to the borrow pit is located at Chainage 18 km of Bishkek-Kara-Balta project road. Location of borrow pit is 11 km from junction with the project road.

71. For the first 5 km the access road has asphalt pavement, with agricultural fields on both sides of the road. At 1.5 km from the turn of the borrow pit (slip road to Bishkek-Osh) there is a railway crossing beyond which the settlement of v. Malovodnoe is located. This site (railway crossing) is defined as “dangerous” in the context of ensuring road safety. Starting from 5 km road becomes gravel, but in some places old asphalt pavement remains. For the next 8 km the road is passable but with deep potholes which helps to keep the speed down. The borrow pit site in on the east slope of the Jelamysh River valley. On the west side there is a small locally operated aggregate operation.. Agricultural

fields are located on the west side of borrow pit site. Starting from the 8 km road is not in satisfactory condition. Repairing works are required. There are several houses at 9 km, was well as a large berry farm which, if dusts suppression along the road is not strictly adhered to, could suffer large losses from damaged berry plants and crops. There is small concrete culvert crossing at 10.4 km, the condition of which has to be improved to ensure safe crossing and good water passage. However it will not support large aggregate trucks and therefore a new bride has been built. Annex 14 contains survey maps of the site and its boundary.

72. **The Sokuluk borrow site** consists of two work zones Sokuluk 1 and 2. **Sokuluk No. 1-** The permitted extraction volume for borrow pit “Sokuluk-1” is 90 200 m3. The turn off to the borrow pit is located at 23 km of the Bishkek-Osh road (Bishkek-Kara-Balta site). The borrow pit is located at a distance of 3.3 km from the junction to Bishkek-Osh road. The road is paved (condition of which is not satisfactory), except a 200-400 m, section which was improved during the reopening of this site, situated in the old riverbed . The nearest house is located on the west side of the hill at a distance of more than 600 m.

73. **Sokuluk No.2**- The extraction area permitted at t “Sokuluk-2” is 47,570 m2. The turn off to the pit is at Km 27.5 of Bishkek-Osh road (Bishkek-Kara-Balta site) and is 7.7 km from the junction to Bishkek-Osh road.

74. Road has asphalt pavement except 200-400 m,with some improvements completed. The road passes next to houses in the v. Sokuluk village before passing under the railroad at 2.5 km. This site is defined as “dangerous” in the context of ensuring road safety. There is Sokuluk poultry farm before crossing which is located at some distance from the road. Further, on the right side of the road, there are agricultural fields and on 3 km of the road local companies use this site as well. Behind the crushing equipment there are pasture lands on both sides of the road and there are the few houses in the v. Pervoe Maya village on the right side. There is an existing asphalt concrete plant with crushing station on the left side. The distance from borrow pit site to nearest houses is 300 m, opposite the “Sokuluk-2” borrow pit’s location.

75. **Ak Suu borrow area** is in the Ak Suu River floodplain at two locations. The site is located 4.0 km to the southwest of the village Belovodskoe and confined to the former floodplain and first terrace above the floodplain of the Ak Suu River.

76. Ak-Suu1 is located in the Ak-Suu River’s dry riverbed. The excavation area permitted for for “Ak-Suu1” borrow pit (Picture 6) is 86,800 m^2. The turnoff to borrow pit is located at Km 44 km of the Bishkek-Osh road, and . 2.5 km from the junction to the Bishkek-Osh road. The road leading to borrow pit passes between Petrovka and Belovodsk ayil okmotu. At the beginning of the road there are houses in the village of v. Petrovka. Further there are wastelands on both sides behind the mosque, and at the 2 km there is crossing under the railway. This site is defined as “dangerous” in the context of ensuring road safety (Photo 1), behind which over a distance of 2.5 km “Ak-Suu-1” borrow pit is located. On the opposite side of the road to borrow pit there is a Christian cemetery (Photo 2). The nearest houses are located more than 800m from this site.

77. Ak-Suu 2- is in the riverbed of the Ak-Suu River and the permitted extraction area is 486 700 m2. Borrow pit site is located at a distance of 8.6 km from the junction to Bishkek-Osh road, At 5,5 км from the junction to Bishkek-Osh road there are houses in the v. Ak-Torpok. Width of the road on this site is 4 m. About 0,5 km of the road passes through the village Ak-Torpok before the turn to borrow pit. Width of the road on this site is 4 m;

78. Exception for 200 m which should be improved during the development of borrow pit, the rest of the haul road is asphalted.

79. About 500 m of the road (from the point of origin of the village of Ak-Torpok) before turning to the borrow pit) passes through the village of Ak-Torpok. Due to the old river bank , access to the borrow pit sits 30 m above floor of the site where all material extraction and processing is taking place. This feature of the relief reduces the noise emission during the operation of a borrow pit. The distance from the edge of the borrow pit to the school is 600 m, and to the nearest house is 400 m. This is in compliance with national and local specifications.

80. **The Kara Balta borrow site** is near to the Bishkek-Dzhambul road, 3 km south of Kara Balta town. The deposit is confined by the irrigation canal from the east and by agriculture land from the west. Morphologically, the sand-and-gravel deposits of the Kara-Balta borrow area are confined to the bottom of the old and now dry Chon-Kaindy River and to its first, second and third terraces above the floodplain. The content of clay particles ranges from 3.4% to 15.2%, therefore, sands of the Kara-Balta deposit should be washed. Kara Balta borrow area is located roughly 3 km north from Kara Balta. The access road goes through Kara Balta residential areas. Dust management has to address on the unpaved sections which go through settlements along the way.

IV. Climate

81. Kyrgyz Republic’s location 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.

82. 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.

83. 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.

84. 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.

85. 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.

86. 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.

V. Water Resources

87. Hydrography of the project road area consists of three permanent streams originating in the northern slopes of the Kyrgyz ridge and crossing the project road. These are the Dzhelamysh, Sokuluk and Ak Suu rivers belonging to the Chu river basin. The rivers scarp slopes covered with trees and shrubs. The width of riverbeds in the mountains is 10-15 m. Bottoms are composed of pebble and boulders and are deformed significantly. When coming out of the mountains, the most river flow is distributed for irrigation. As a result, for most of the year (growing season) there are no flows in the places where the rivers cross the road.

Dzhelamysh River

Sokuluk River.

Ak-Suu River

Figure 4 The three natural rivers (Table 8) flow north under the road into the Chu River.

Table 7. Main hydrological features of the three rivers crossing the project road.

River	Watershed area, km^2	Origin distance, km	River slope, $^0/_{00}$	Average weighted watershed height, m	Freezing, %
Dzhelamysh	153	25	65	2650	4
Sokuluk	353	26	68	3110	12
Ak-Suu	426	31	60	3060	7

Source: Archive data from Kyrgyzhydromet

88. The hydrological regimes of the Dzhelamysh, Sokuluk and Ak-Suu Rivers have been recorded since 1928 and 1998, and these data are presented as the percentage of total annual streamflow in any given month (Table 9). Unfortunately more recent data are not available and since the gauging stations were located much further upstream from where the road crosses the rivers, the values provide are not really representative of conditions at the crossing points.

Table 8. Annual stream flow distribution as a % of the annual flow

River	Average water flow rates (m3/sec), % of the annual flow											
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Dzhelamysh	4.6	4.3	4.2	5.5	8.5	13.6	17.0	15.2	8.9	6.6	6.0	5.5
Sokuluk	2.7	2.4	2.3	2.5	6.0	15.5	23.9	22.7	10.2	4.9	3.7	3.2
Ak-Suu	2.8	2.5	2.5	2.9	6.4	17.7	23.7	19.2	9.5	5.5	4.0	3.3

Source: Archive data from Kyrgyzhydromet

89. Three irrigation canals are also crossed by the road (Figure 5). They are the Novo-Pavlovka flood control canal, Zhantay2 and the Krepostnoy canal. A 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.

90. The Zhantay canal originating in the water intake structure on the Sokuluk river (in the piedmont zone) goes through the boundary of Romanovka and Sokuluk villages. The canal is designated for passing of water to irrigate backyards and agricultural fields of villages located downwards the road. This canal has been designed also for passing of mud streams formed in the piedmont zone after rain showers. The canal capacity is about 6-8 m3/sec. However, currently the functions of the canal are significantly limited since the canal bed is silted with debris and built-up with dwelling houses.

Flood canal in Novo-Pavlovka Village

Zhantay canal in Sokuluk Village

Krepostnoy canal in Belovodskoye Village

Mudflow canal of Ak-Suu river in Petrovka V.

Figure 5. Canals crossed by the road upgrading work.

91. The Krepostnoy canal is located in Moscowskiy village and crosses the road at the entrance to Belovodskoe village. The canal is designated not so much for irrigation of cultivated lands owned by adjacent villages, but for discharge of mudflows formed in the piedmont zone during rain showers. The canal is densely covered with trees and shrubs and silted with debris by half, and a capacity is about 18 m3/sec. There is a bridge at the

boundary of Belovodskoe and Petrovka villages providing the pass of a part of maximum flood that goes by the Ak-Suu river. The stream passes through the culvert under the railway bed located above the road, breaks down into two streams and forms a sort of the second mudflow canal of the Ak-Suu River. Maximum water discharges here can reach 20 m3/sec (Table 9).

Table 9. Summary of rivers and irrigation structures

#	Station, km.	Watercourse	Maximum water discharge,(m^3/sec)	Structure	Length, width
1	17 + 900	Dzhelamysh River	37.6	Bridge	18 x 12
2	22 + 200	Zhantay 2 canal	18	Culvert	6 x 10
3	27 + 700	Sokuluk River	61.5	Bridge	24 x 10
4	40 + 390	Krepostnoy canal	up to 20	Culvert	6x 10
5	43 + 500	Ak Suu River	47.7	Bridge	23 x 10
6	44 + 100	Mudflow canal of Ak Suu River	up to 20	Culvert	13 x 10

Source: archive data of Kyrgyzhydromet, survey materials.

92. “The *Index of Mudflow Dangerous Rivers of Kazakhstan, Central Asia and Eastern Siberia*” describes the rivers Dzhelamysh, Sokuluk and Ak-Suu as mudflow dangerous. Occurrence of mud floods is usually connected with rainfall, but they could also occur as a result of breach of high mountain lakes *(basin of Sokuluk river, 1983, breach of the Keidy-Kuchkach glacier lake, the mudflow discharge – 210m3/sec, discharge near Sokuluk village – 67.4m3/sec).*

93. The maximum mud flood on the Ak-Suu river occurred on 30.07.1988 when its discharge rate was 64.3 m3/sec. Rain showers in the piedmont zone caused the flood. Mudflows occur in the river basins at least once every two years, but rarely up to three times in one year. Usually such floods occur locally and do not affect strongly the rivers regime.

94. **Bridges-** The bridges along Bishkek – Kara Balta road section will require the following level of repair:

1. Km17 (Total reconstruction)- Jelamysh
2. Km23 (Total reconstruction) –Zantay Canal
3. Km27 (Total reconstruction) –Sokuluk River
4. Km40 (Total reconstruction) –Keropstnoy Canal
5. Km43 (Total reconstruction)- Ak Suu River
6. Km44 (Total reconstruction)- Mudflow canal for AkSuu River

VI. Air Quality

95. Air pollution levels in the Kyrgyz Republic are a serious concern 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. There are no known roadside emitters within the project corridor.

96. Air pollution monitoring by Kyrgyzhydromet was conducted intermittently at 7 stations 3 times a day in 2013, 2015 and 2017.

97. Details on all monitoring results through 2017 are presented in Chapter V, Section A and Table 17.

VII. Noise

98. Existing ambient noise levels (Table 35) along the road section from Bishkek to Kara-Balta are generally attributable to vehicular traffic and the construction starting in 2017. Quarrying operations are a minimum of 3 km from the road and therefore do not contribute to the corridor's noise environment. Residential areas are located in the vicinity of the road. Baseline noise measurements showed that within 20m of the edge of pavement noise levels regularly exceeded KR standards (Table 3).

99. The specialist consultant also modelled baseline noise levels and noise conditions were predicted to be 15 dBA to 17 dBA above both Kyrgyz and IFC standards for day and night time conditions respectively (Hagler Bailley, 2018)[4].

100. These modelling results corroborate the measurement taken in the field since 2013 (Table 35).

VIII. Vibration

101. 2013 vibration measurements showed that the roadside residents were receiving intermittently high ground vibrations. These could not be properly quantified since the measurement units were in dBA instead of ppv. Nevertheless the data indicated that most dwellings within 20m of the road had periodically high vibration conditions. While not technically determined these ground vibrations were likely due to passing of heavy vehicles passing by on the national highway.

B. Ecological Resources in Project Area

102. The ecological conditions along the project road reflect mostly urban and semi urban conditions with a ribbon development along all but the last 10 km of the road. There are no specially protected natural areas in the immediate vicinity of the project area.

I. Fauna

103. Diversity of species in the Kyrgyz Republic is very high. Over 500 species of vertebrates, including 83 mammals, 368 reptiles and 75 fishes are reported, along with 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.

104. The project road passes mainly through settlements and some agricultural fields. Biodiversity there is minimal compared to natural ecosystems and is consistent with stress tolerant animal specie found in the corridor. 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, fox, and during the in winter period — wolf.

105. Bird species in the sections are more diversified. Species along the project roads include tree and house sparrow, Afghan starling, blackbird, great tit, magpie, blue rock pigeon, dove, and white stork can be met by a nesting place. Wildlife representatives include lark, quail, buntings, and representatives of coraciiform, European chat. There are varmints in the fields, such as goshawk, sparrow hawk, common buzzard, long-legged buzzard, rough-legged buzzard, black kite, snake eagle, greater spotted eagle, common kestrel, hobby falcon. The Bazar-Korgon reservoir is the place of residence, seasonal

[4] Hagler Bailley Pakistan. 2018. Noise Modelling of 45.1 km Bishkek-Kara Balta Road, Baseline, construction and operation period. Internal report of Government of Kyrgyzsgtan. 79 pgs, plus three Annexes (noise contour mapping).

migration and wintering for a great number of water and semi-aquatic birds, such as diving duck, duck, goose, swan, shore birds, takapu, etc.

106. Herpetofauna is represented by lake frog, green toad, Central Asian tortoise, gray gecko, Turkestan agamids (lizards), desert lidless skink, diced snake, sand boa, arrow snake, Orsini's viper.

107. The road section from Bishkek to Kara-Balta has been heavily disturbed by urban and agricultural development. Habitat for threatened or endangered wildlife species along the corridor was not found.

II. Flora

108. 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 Kara-Balta 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.

109. 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 Bishkek – Kara-Balta section are planted with windbreak, including small-leaved elm (English elm), Lombardy and white poplars. There are no any special protection zones in the vicinity of the road corridor.

110. Within and outside the road shoulder areas 4-5 species of trees were planted between 40 and 60 years ago to provide a windbreak and shade for road travellers. Since the area is an open steppe habitat without trees to speak of, the planners also provide forest-patch habitat for local area fauna such as rabbits, rodents and birds. There are more than 10,000 mature trees in this zone between Bishkek and Kara Balta. An inventory of the tree within the RoW and those scheduled for clearing to make way for the road upgrading are listed in Annex 4 of this IEE. Further mapping of the tree locations and planned cutting was also completed in 2017 and is included as an annex to this IEE.

III. Desertification

111. 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 a some stage of desertification.

112. In the north 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 have been degrading. Though the areas of actual irrigated farming land is 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.

113. 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

I. Population

114. The Kyrgyz Republic is a sparsely populated country. The population is almost six million people (2014), of which approximately one third) live in towns and two-thirds in rural areas. The road section of the project is located in Chuiskaya Oblast. This is divided into three Rayons and the City of Bishkek. Along the project road, there are roughly 177,000 inhabitants (2015).

Table 10. Population along the Bishkek-Kara Balta Project Road

Oblast	Rayon	Distance from the beginning of the road (km)	Name of settlement	Population: 01.01.2015 (thousand people)
	Bishkek city	9	Ala-Too microdistrict	
Chuiskaya	Sokulukskiy	9.00 - 10.9	**Novopavlovka** (≈50 households)	18.332
		10.9 – 14.4	Voenno-Antonovka	15.067
		19.5 – 22.3	Gavrilovka	3.258
			Shopokov	9.383
		22.3 – 23.9	Romanovka	3.102
		23.9 – 29.4	**Sokuluk** (≈40 households)	13.488
	Moscowskiy	29.4 – 33.4	Alexandrovka	13.470
		33.7 – 44.2	Sadovoye	8.606
			Belovodskoye (≈80 households)	21.237
		44.2 – 52.0	Petrovka	9.253
	Zhayilskiy	52.8 – 57.5	Poltavka	4.205
			Novo-Nikolaevka	8.223
		57.5 – 60.0	Petropavlovka	2.304
		60.0 – 65.0	**Kara-Balta**	43.239
			Kalininskoye	3.701

Source: National Statistical Committee of KR, 2015

II. Social Infrastructure

115. The Kyrgyz Republic is one of the poorest and least industrialized countries in the Europe and Central Asia region with a GDP of $350028.4 (thousand som), low labor and social protection, a poverty level of 33.7 % (2010) and a life expectancy of 69 years (2009). However, literacy rate remains high at >99% among people aged 15 and above (2009).

Table 11. Key social and economic indicators (Kyrgyz Republic)

		2012	2013
1	Resident population (thousand people)	5663.1	5776.6
2	Natural population growth (thousand people)	118.7	120.7
3	Total GDP (thousand som)	310471.3	350028.4
4	% in GDP:		
5	Agriculture	16.7	15.2
6	Industry and construction	22.2	22.9

7	Services	48.0	47.6
8	GDP per capita, thousand som	58.0	64.1
9	GDP in % to a previous year	99.9	110.5

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

116. Official statistics show that the spread of poverty in the country is uneven. Figure 3 shows regional disparities in poverty.

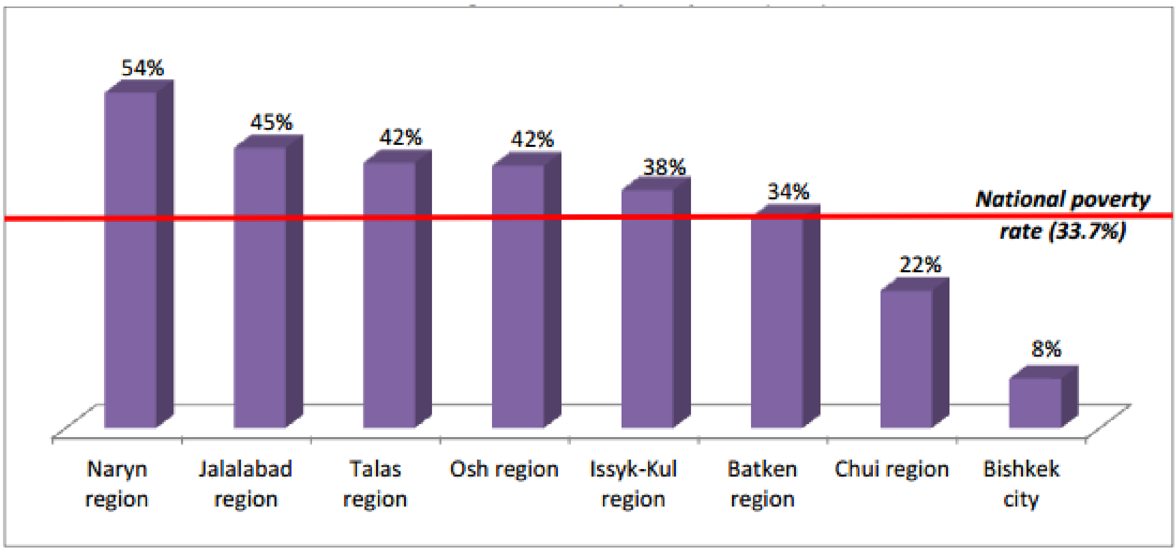

Figure 6: Regional disparities in poverty level by region in Kyrgyz Republic.
Source: Energy and communal services in Kyrgyzstan and Tajikistan: A poverty and social impact assessment.

Table 12. Poverty level in Chui oblast (%) in 2013[5]

Location	Total	Urban population	Rural population
Chui Oblast	23,6	12,0	26,2

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

117. The 2014 data of the Integrated Household Survey in Chui Oblast showed that out of the total number of 522.067 thousand active citizens 48.8% were women and 51.2% were men. The unemployment rate was 8.4% (9,8 % for women and 7,4 % for men). Unemployment is more severe in urban areas (10,9 % and 10,0 % subsequently) than in rural areas (9,1 % and 6,1 %).

Table 13. Resident population by age groups in 2014 (thousand people)

	Total	Female	Male	Ratio in %	
				Female	Male
Chui oblast	853,725	433,396	420,329	50.8	49.2
Under active working age	254,174	123,790	130.384	48.7	51.3
Active working age[6]	522.067	254,837	267.230	48.8	51.2
Above active working age	77,484	54,769	22.715	70.7	29.3

Source: NSC. Statistical book «Kyrgyz Republic Annual Demographic Report».

[5]A poverty line of 2012 adjusted to an average annual consumer price index was used to assess a level of poverty. The poverty line indexation is made in accordance with the "Methodology for determining the poverty line" adopted by the Kyrgyz Government Resolution dtd. March 25, 2011. The cost value of total poverty line in 2013was 27 769 som/year per capita, and extreme poverty line - 16 249 som.

[6] Active working age of population covers 16-62 aged men and 16-58 aged women.

III. Access and Severance

118. With any heavily used highway that has few at-grade crossings, access and severance from one side of the highway to the other is a serious concern. The public will take this into their own hands and jaywalk, greatly increasing the risk of accidents and potentially fatalities. To address this MOTR and the local communities had installed 10 at grade signalled crossing and a few other marked but not signalled crossing points. The general idea at that time was to provide a signalled crossing at every major intersection where a signal was needed anyway. There are also 3 underground passages, presently unusable as these are filled with garbage and used as roadside toilets.

119. For all roadside residences and businesses, severance remains a fact of life. The concrete median barriers remain in place, blocking crossings at all but the signalled intersections and areas outside the urban zones.

Agriculture and Industry

120. Agriculture is big employer in Kyrgyz Republic and accounts for around one quarter of the GDP. From 1995 to 2010 the share of agriculture from the GDP of Kyrgyz Republic has declined and the average productivity of an agricultural sector worker has increased. Table 14 shows the evolution of total labour force and the share of agricultural workers from 1997 to 2012. (Source: FAO Country Profiles).

Table 14. Total labour force and the share of agricultural workers in Kyrgyz Republic

Kyrgyzstan: Evolution of population and labour force size							
	Size [Millions]				Annual growth rate [%]		
	1997	2002	2007	2012	1997-2002	2002-2007	2007-2012
Total population	4.74	5.00	5.14	5.45	1.07	0.55	1.18
Agricultural population	1.31	1.24	1.15	1.08	-1.09	-1.5	-1.25
Total labour force	1.96	2.14	2.30	2.53	1.77	1.45	1.92
Labour force in agriculture	0.54	0.53	0.51	0.50	-0.37	-0.77	-0.4
Source: FAOSTAT, FAO of the UN							

Transport and Traffic accidents

121. 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.

122. 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.

123. 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.

124. There is a need for some practical guidance for teachers on how to pass on the road safety message to children. 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.

125. 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 crashes are within the 45.1 km long section.

Cultural and Historical Sites

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

IV. ALIGNMENT SHEETS

127. The following alignment sheet provides an overview of environmentally sensitive hotspots and representative set of sensitive receptors alongside the Project road. The alignment sheets serve as a base for the following impact analysis, but no way suggest that the rest of the roadway is not impacted or that the IEE does not cover this area.

Table 15. Alignment Sheets

No.	Location	KM	Issue / Picture	Baseline Data Parameters
			Section Bishkek to Kara Balta	
1	Village of Novopavlovka	9 to 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.	Dust, Noise, Vibration, SO2 NOx CO Baseline measurements taken with moveable instruments along the Project road.
2	Novopavlovaka v.		 Secondary School No.2	

No.	Location	KM	Issue / Picture	Baseline Data Parameters
3	Voenno Antonovka village	13.1	Sensitive receptor. Secondary school of Voenno-Antonovka village  Secondary School in Voenno-Antonovka v.	Dust, Noise, vibration SO2 NOx CO
4	Voenno Antonovka village	14.2	Sensitive receptor.  Mosque	Dust, Noise, Vibration, SO2 NOx CO
5	Along the Project road	17	Below picture show tree plantation of Elms at km 17, right hand side of road. 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, approx. 4500-7000

No.	Location	KM	Issue / Picture	Baseline Data Parameters
6	Gavrilovka	21.7 to 23	Village of Gavrilovka and Shopokov town. Sensitive hotspot with residential houses, shops, kinder garden, schools and shops alongside the Project road.  School in Gavrilovka v.	Dust, Noise, Vibration, SO2 NOx CO Baseline measurements with moveable instruments along the Project road.
7	Gavrilovka v.		 Kinder garden in Gavrilovka v.	
8	Sokuluk town	25 to 30	Sensitive hotspot with administration buildings, schools, church, mosque, residential houses, shops and market adjacent to the Project road.	Dust, Noise, Vibration, SO2 NOx

No.	Location	KM	Issue / Picture	Baseline Data Parameters
9	Sokuluk town		 Market  Residential houses, shops	CO Baseline measurements with moveable instruments along the Project road.
10	Sokuluk town		 Secondary School No. 2	
11	Aleksandrovka	31.3 to 33.4	Sensitive receptors: secondary school no. 1 and 2 and mosque, wholesale market,  Secondary School No. 3	Dust, Noise, Vibration, SO2 NOx CO

No.	Location	KM	Issue / Picture	Baseline Data Parameters
12	River Crossings	28.3, 43 and 44.65	Crossings of River Sokuluk, temporary creek and River Ak-Suu, Zhalamysh river by Project road. Below picture shows relict of floodplain vegetation, e.g. willow (*Salix alba*) alongside the temporary creek at chainage km 43.   	pH dissolved oxygen oil products turbidity total suspended solids conductivity temperature lead
13	Belovodskoe	42 to 45	Sensitive hotspot. Belodovske town with residential houses, shops, Church and Mosque, market. Commercial area with supermarket. Businesses are on both sides of the road. Design solution mitigates physical impact as far as technically feasible.	Dust, Noise, Vibration, SO2 NOx CO

No.	Location	KM	Issue / Picture	Baseline Data Parameters
			 Market	
14	Petrovka v.	50.6	Sensitive receptors. Secondary schools, houses.  Secondary School in Petrovka v.	Dust, Noise, Vibration, SO2 NOx CO
15	Jayil Rayon	48 to 60	Three secondary schools at chainage 50.6, 55 and 57, houses behind the tree, which will be cleared, monument. At km 59 Sensitive receptor secondary school of Novonikolaevka.  Tree plantations in between project road and residential houses reduce emission to residential areas. Planting of new trees as compensation measures.	Quantity of felled trees, approx. 4,300-7000

No.	Location	KM	Issue / Picture	Baseline Data Parameters
				

V. BASELINE MEASUREMENTS

128. Baseline measurements were conducted as indicated in Table 16, in 2013 and again in 2015. Given the long lag time between the completion of the environmental documents in 2015 and the implementation of the work in 2017 a new round of air, noise and water quality testing was completed in May 2017 (See SSEMP ANNEX 2 for details). A summary of these findings is presented in this section of the IEE.

A. Air Quality Measurements

129. Measurement results will serve as monitoring reference values during the construction phase. Air quality was measured at 16 sites (Table 16) along the route, identified as being sensitive to air pollution, due to the proximity of schools, outdoors markets and other special facilities.

Table 16. Air Quality Sampling Stations, 2015 and 2017

#	**Station No (2013/2015). 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)
5	New 5 - Gavrilovka village (kindergarten)
6	207/6- Gavrilovka village (dwelling house, 50, Frunze street)
7	New 7 – Shopocov town (school #2)
8	208/8 – Sokuluk village (market)
9	209 /9– Sokuluk village (school #2)
10	New 10 – Sokuluk village (housing estate)
11	210/11– Alexandrovka village (school #3)
12	211/12 – Belovodskoye village (market)
13	212/13 – Petrovka village (dwelling house)
14	213/14 – Poltavka village (school, no number)
15	214 /15– Petropavlovka village (school, no number)
16	215/16– Novonikolaevka village (school, no number)

** Locations 1-3 retained for continuity and for an improved time series data

130. Measurements were taken twice, first in June 2013 and again in June 2015, 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, 416143004, 413411.042 (ИБЯЛ)[7].

131. The results for 2013 (Table 17) showed that KR standards for sulphur dioxide were exceeded in all locations and for carbon monoxide at nine of the 15 sampling sites, suggesting serious air pollution, along the corridor. Interestingly TSP for both 2013 and 2015, which given the high level of traffic and commercial activity along the corridor, should be much higher, than the highest concentration measured at 0.0028 mg/m^3. These measurements suggest alpine air in a pristine environment. They are suspect and as such will be monitored carefully during the construction and into the operating period of the project. Nitrogen oxide within standard requirements for 13 of the 16 monitoring stations.

132. Four parameters were monitored in 2013, 2015 and 2017. Samples were collected at all locations in 2015 and 2017. A listing of all numerical data collected is presented in Table 17.

[7] 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.

133. These new data suggest a reduction in emission for these four parameters. However given the wide variation of the readings among the three collection years, there is strong chance that sampling and analytical errors may be giving false results. For that reason the sampling will continue through the construction period.

Table 17. Existing ambient air quality within 100 meter of impact corridor measured in 2013, 2015 and 2017 (mg/m^3)

Station Number	Location**			CO			NO2			SO2			TSP		
	Name	Dist. From EOP (m)	Chainage From Bishkek (km)	2013	2015	2017	2013	2015	2017	2013	2015	2017	2013	2015	2017
1	Novopavlovka village (school)	33	9.9	6.5± 1.6	1.2± 0.24	0,4±0,08	<0.01	0.070 2017 0.018	0,023± 0,0058	3.2± 0.8	0.004± 0.001	0,004± 0,001	<0.1	1.6± 0.4	0,4±0,1
2	Novopavlovka village (market)		11.0	3.8± 0.95	2.3± 0.46	2,9±0,58	<0.01	0.079± 0.020	0,3± 0,075	2.3± 0.6	0.007±± 0.0018	0,009± 0,0023	<0.1	2.2± 0.6	0,5±0,13
3	Voenno-Antonovka village (school)	50	12.86	4.9± 1.2	1.2± 0.24	0,8±0,16	<0.01	0.018± 0.0045	0,22± 0,055	1.2± 0.3	0.002± 0.0005	0,007± 0,0018	<0.1	2.3± 0.6	0,5±0,13
4	Voenno-Antonovka village (mosque)	10	14.2	6.2± 1.6	1.6± 0.32	2,4±0,48	<0.01	0.041± 0.010	0,22± 0,055	1.2± 0.3	0.002± 0.0005	0,006 ±0,001 5	<0.1	0.24± 0.6	0,7±0,18
5	Gavrilovka village (kindergarten)	30	21.5	6.4± 1.6	1.0± 0.2	0,4±0,08	<0.01	0.002± 0.0005	0,037± 0,009	1.5± 0.4	0.002± 0.0005	0,003± 0,0008	<0.1	2.8± 0.7	0,8±0,2
6	Gavrilovka village (dwelling house, 50, Frunze street)	20	20.95		1.6± 0.32	0,4±0,08 0		0.063± 0.016	0,034± 0,0085		0.003± 0.0008	0,003± 0,0008		3.5± 0.9	0,5±0,13
7	Shopokov town (school)	20	22.33		1.6± 0.32	0,5±0,1		0.060± 0.015	0,18±0 ,045		0.006± 0.0015	0,004± 0,001		1.6± 0.4	0,5±0,13
8	Sokuluk village (market)	10	27.15	10.4± 2.6	3.6± 0.72	0,9±0,18	<0.01	0.084± 0.021	0,042± 0,011	1.1± 0.3	0.009± 0.002	0,003± 0,0008	<0.1	2.0± 0.5	0,15± 0,038
9	Sokuluk village (school)	15	27.5	5.5± 1.4	2.1± 0.42	0,4±0,08	<0.01	0.057± 0.014	0,039± 0,01	1.1± 0.3	0.004± 0.001	0,004± 0,001	<0.1	2.0± 0.5	0,4±0,1
10	Sokuluk village (housing estate)	10	25.6		1.5± 0.3	0,5±0,1		0.055± 0.014	0,13± 0,033		0.003± 0.0008	0,004± 0,001		1.8± 0.5	0,3± 0,075
11	Alexandrovka village	80	30.5	5.6± 1.4	1.6± 0.32	0,4±0,08	<0.01	0.060± 0.015	0,034± 0,0085	1.6± 0.4	0.003± 0.0008	0,003± 0,0008	<0.1	1.8±0. 5	0,4±0,1
12	Belovodskoye village (market)	10	43.0	9.9± 2.5	4.2± 0.84	1,2±0,24	<0.01	0.081± 0.020	0,12±0 ,03	1.1± 0.3	0.003± 0.0008	0,004± 0,001	<0.1	0.8± 0.2	0,3±0,07 5
13	Petrovka village (dwelling house)	10	51.0	2.5± 0.6	1.7± 0.34	0,6±0,12	<0.01	0.042± 0.011	0,042± 0,01	0.8± 0.2	0.002± 0.0005	0,003± 0,0008	<0.1	1.2± 0.3	0,9±0,23
14	Poltavka village (school)	30	55.0	2.6± 0.7	13± 0.26	0,3±0,06	<0.01	0.018± 0.005	0,038± 0,01	0.6± 0.2	0.001± 0.0003	0,004± 0,001	<0.1	1.6± 0.4	1,00,25
15	Petropavlovka village (school)		57.1	2.3± 0.6	1.5± 0.3	0,1±0,02	<0.01	0.040± 0.01	0,032± 0,008	0.8± 0.2	±0.003	0,003± 0,0008	<0.1	1.3± 0.3	0,3±0,07 5

Station Number	Location**			CO			NO2			SO2			TSP		
	Name	**Dist. From EOP (m)**	**Chainage From Bishkek (km)**	**2013**	**2015**	**2017**	**2013**	**2015**	**2017**	**2013**	**2015**	**2017**	**2013**	**2015**	**2017**
16	Novonikolaevka village (school)		59.53	*7.3± 1.8*	1.1± 0.22	1,3±0,26	<0.01	0.030± 0.008	*0,13±0 ,033*	*1.2± 0.3*	0.002± 0.0005	0,003± 0,0008	<0.1	1.4±0. 4	0,7±0,18
Standard (MPC)				**5**	**5**		**0.085**	**0.085**		**0.5**	**0.5**		**0.5**	**0.5**	

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

I. 2017 Baseline Update

134. **Carbon Monoxide (CO)**-Carbon monoxide levels as measured in 2013 exceeded maximum permissible concentrations (MPC) at six of 16 stations, whereas in 2015 (the year EPTISA began monitoring) only the Poltavka School station had a CO concentration of 13 mg/m^3 with a variation of only 0.25 mg/m^3. The MPC for CO is 5 mg/m^3 , signalling a serious exceedances, especially at a school (Figure 11). IPIG was made aware of this reading in the IEE.

135. **Nitrogen Dioxide (NO_2)-** NO_2 is a by-product of the combustion of petrol from vehicles and any internal combustion engine. Therefor, roadside levels are generally at or exceeding the MPC levels for Kyrgyzstan, which is 0.085 mg/m3, .The 2013 levels were all recorded as < 0.01 mg/m3. The 2015 results showed that none of stations had levels exceeding the MPC.

136. **Sulphur Dioxide (SO_2)-**For 2013 SO2 levels exceeded the MPC level at all 13 stations, while for 2015 levels were all below 0.005 mg/m^3 (Figure 13). This very large variation suggests sampling or analytical errors. .Construction period monitoring over a longer time period should provide a better indication of local SO2 concentrations.

137. **Total Suspended Particulate Matter (TSP)**- TSP levels during the three sampling years varied enormously, with the most consistent being 2015 where all but the Voenno-Antonovka Village mosque site exceeded the MPC level of 0.5 mg/m^3. These data suggest that background levels of TSP exceed Kyrgyz MPC and that dust control will be an important construction period mitigation measure (SP 2.5 and 10 not measured due to lack of instrumentation in KR).

B. Water Quality

138. Surface water quality measurements were taken in July 2013 and April-May 2015, and again May 2017. In July 2013, the water quality measurements were conducted on only one stream (Table 18) in Belovodskoe village since the rivers and channels in the places of intersection with the road had no flow as the water was taken for irrigation purposes.

139. Sampling was done according to GOST P 51592-2000 «Water. General sampling requirements», WSS 33-5.3.01-85 «Instruction on sampling for wastewater analyses». Legislative requirements were observed.

Table 18. Water quality of the Belovodskoye Village stream

Name of ingredients	Unit of meas.	July 5, 2013 Analysis data	MPC*	Regulatory document
pH		7.71	6.5-8.5	Economic Relations Council, p.1, M.1977
Clarity	cm	0.0	-	Economic Relations Council, p.1, M.1977
Conductivity	μs/cm	383	-	Economic Relations Council, p.1, M.1977
Suspended solids	mg/l	2346	0.2 to 0.75	Economic Relations Council, p.1, M.1977
Oil and grease	mg/l	Not measured	0.3	ERD F 14.1:2:4.128-98
Copper	mg/l	<0.0006	1.0	Methodical Instructions 08-47/091
Zink	mg/l	<0.0005	1.0	Methodical Instructions 08-47/091
Cadmium	mg/l	<0.0002	0.001	Methodical Instructions 08-47/091
Lead	mg/l	<0.0002	0.01	Methodical Instructions 08-47/091

***** NR 2.1.5.1315-03, MPC of chemical substances in water bodies of public and cultural general water use, Ministry of Health Protection, Russia, Moscow, 2003.

140. As with the 2013 data, the 2015 survey (Table 19) showed that the water in the rivers remains relatively clean and meets the chemical substances MPC requirements for water bodies These waters are designated non-potable (without treatment) and used for irrigation purposes.

141. Aside from the highly variable TSS levels at three of the stations the difference in test results between 2015 and 2017 (Table 19) were small and indicated no issues. Given that these waters are snow melt and storm water runoff streams, the steep rise and fall of TSS levels is normal.

Table 19. Surface water quality monitoring data for Bishkek-Kara-Balta (km.15.9 – km.61), 20115 and 2017

Sampling location	St. No No/Yr./ Reps	Date and time of sampling	Weather conditions	Coordinates	pH	BOD 5, mg /l	Conductivity, (µs/cm)	Suspended solids, mg/l	Oil and grease, mg/l	Copper, mg/l	Zinc, mg/l	Cadmium, mg/l	Transparency, cm
Orto-Suu village, km.55, pond 2015	1-'15	28.04.2015 10.50	sunny	N 42^0 $42^/$ $27,5^{//}$ E $0,75$ $^0 50^/$ $29.8^{//}$	8.72	3.0	564	6.4	0.23	<0.0006	<0.0005	<0.0002	
Orto-Suu village, km.55, pond 2015	1-'15-1	22.05.2015 09.40	sunny	same	8.73	2.8	511	10.6	0.03	<0.0006	<0.0005	<0.0002	
Orto-Suu village, km.55, pond 2017	1-'17	27.04. 2017 10.50	sunny	same		3.6		12.8	0.014				20
Ak-Suu river* in front of a bridge, km.43+500 - '15	2-'15	28.04.2015 11.15	sunny	N 42^0 49 $^/49,3^{//}$ E $0,74$ $^0 04^/$ $55,1^{//}$	8.32	0.7	383	52.8	0.04	<0.0006	<0.0005	<0.0002	
22.05.15	2-'15-1	22.05.2015 09.57	sunny	same	8.07	1.2	299	1178.0	0.05	<0.0006	<0.0005	<0.0002	
27 04-17	2-'17	27.04. 2017 11.25	sunny	Same		2.2		236.0	<0.013				4.5
Sokuluk river** in front of a bridge Km.????	3-'15	28.04.2015 12.05	sunny	N 42^0 $51^/$ $22,3^{//}$ E $0,74$ $^0 16^/$ $36,2^{//}$	8.43	0.2	325	9.0	0.14	<0.0006	<0.0005	<0.0002	
	3-'15-1	22.05.2015 10.44	sunny	Same	7.98	1.0	214	256.8	<0.02	<0.0006	<0.0005	<0.0002	
	3-'17	27.04. 2017 11.55	sunny	Same		0.8		59.2	<0.013				10

Sampling location	St. No No/Yr./ Reps	Date and time of sampling	Weather conditions	Coordinates	pH	BOD 5, mg /l	Conductivity, (µs/cm)	Suspended solids, mg/l	Oil and grease, mg/l	Copper, mg/l	Zinc, mg/l	Cadmium, mg/l	Transparency, cm
"Krepostnoy" narrow bridge at km.27+150	4-'15	28.04.2015	dry bed	N 42^{0} $50^{/}$ $02,0^{//}$ E 0,74 $^{0}07^{/}$ $20,2^{//}$	-	-	-	-	-	-	-	-	
	4-'15-1	22.05.2015	dry bed	same	-	-	-	-	--	-	-	-	-
	4-17	27.04. 2017	Dry bed		-	-	-	-	-	-	-	-	-
"Zhantay"canal ** Vostochnaya street km. 24+110	5-'15	28.04.2015	dry bed	N 42^{0} $51^{/}$ $52,6^{//}$ E 0,74 $^{0}20^{/}$ $08,9^{//}$	-	-	-	-	-	-	-	-	
	5-'15-1	22.05.2015 10.55	sunny	same	7.85	0.2	252	3859.2	0.08	<0.0006	<0.0005	<0.0002	
	5-'17	27.04. 2017	dry bed										
Zhalamysh river * bridge at km.17+850	6-'15	22.05.2015 11.06	sunny	N 42^{0} $52^{/}$ $10,7^{//}$ E 0,74 $^{0}23^{/}$ $18,1^{//}$	8.03	0.6	263	809.2	<0.02	<0.0006	<0.0005	<0.0002	
	6-15-1	28.04.2015	dry bed	Same	-	-	-	-	-	-	-	-	
	6-17	27.04. 2017 13.05	sunny	Same		2.2		268.6	0.020				0.0
*** MPC for fishery water ponds category**					**6.5-8.5**	**3**			**0.05**	**0.001**	**0.01**	**0.005**	
**** MPC for general use category**					**6.5-8.5**	**3**			**0.3**	**1**	**1**	**0.001**	
Applicable normative legal acts					ERC p.1 M. 1977	MP 2-85	ERC p.1 M. 1977	ERC p.1 M. 1977	ERD F 14.1:2:4.128-98	MI 08-47/091	MI 08-47/091	MI 08-47/091	

C. Noise

I. 2013-2015

142. Existing ambient noise levels within the road section from Bishkek to Kara-Balta are generally attributable to vehicular traffic, and to a much lesser exten construction. All measurements taken starting in 2013 exceeded Kyrgyz standards for both day and night (actually late afternoon to early evening) ; at some locations by many dBAs. Residential areas located along the road have the same noise levels as measured on the road. Sensitive receptors concerning noise emissions are described in detail in Annex 2; including photographs.

143. Noise measurements were taken using the Oktava 101A sound level meter No. 04A445, last calibrated in Dec. 2013. All measurements were taken in compliance with 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”. The data (Table 20) clearly indicate that roadside businesses and residences (16 sensitive receptors) are exposed to noise levels exceeding the KR standards. This is particularly true for schools and hospitals.

144. **Noise Between 0800 and 1100 Hours-** In 2013, four of the 13 measurements taken exceeded the MPC level. For 2015 14 of the 18 stations had noise readings at or above 70 dBA. In 2017 all but the Voenno-Antonovka Village mosque and Sokuluk city dwelling (16) sites had levels below 70 dBA. Given the level of traffic and large percentage of trucks and buses the noise levels will be high and more likely reflect the 2015 survey dataset (Figure 14).

145. **Noise Between 1700 and 1900 Hours**- For all three years of sampling only the 2013 Petropavlovka Secondary School site measurement had a noise level below the 60 dBA MPL for night-time in a commercial zone. Existing night-time noise levels along this roadway are excessive and almost all exceed MPC, reflecting the very high traffic volume stretching into the evening until 2100 hours (base on traffic volume projections).

146. The 2015 results for the 16 sampling sites show that the noise level in the project road section exceeded the MPL for every reading. It is under these conditions that the construction will take place. These high reading in no way reduce the effort needed by the contractor to minimize construction period noise. In fact a potential plan for mitigating some of the most sensitive noise sites will be discussed and actions proposed.

147. The results of field measurements show that the noise level at the area of residential development exceeds the maximum permissible level from 3-20 dB and does not comply with the requirements of SanPiN (Sanitary Regulations and Standards) 2.1.8.562-96 “Noise at workplaces, in dwelling rooms, in public buildings and at the area of residential development”. Basis: 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”.

Table 20. Existing noise levels determined along the road sections, 2013, 2015 and 2017

Noise sensitive sections: Sampling Station No. used on 2013 survey and again in 2015 and 2017 No.		Km from Bishkek	Distance from carriage-way to receptor (m)	Measured Average Noise level, dBA.							
				2013	2015			2017			Day-time
				Field Measurement	Aver-age	08.00 to 11.00	17.00 to 19.00	Aver-age	08.00 to 11.00	17.00 to 19.00	KR 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							**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**
4	Gavrilovka village House along the road,	20.8	30		71	71	71	63	45	81	**55**
5	Gavrilovka village, Kindergarten	21.5	20		75.5	75	76	66	63	69	**55**
6	Shopokov city, School No. 2	22.330	20		75	75	75	67	67	67	**55**
7	Sokuluk city, Dwelling houses (shop “Tatyana”)	27.150	10		75	78	72	73	70	76	**55**
8	Sokuluk city, School No. 2	27.5	15	72	71.5	71	72	64.5	61	68	**55**
9	Sokuluk city, Multi-storied dwelling buildings	25.6	10		76.15	73.3	79	67	63	71	**55**
10	Alexandrovka village, School No. 3	30.5	80	72	60.5	61	60	57	54	60	**55**

Noise sensitive sections: Sampling Station No. used on 2013 survey and again in 2015 and 2017 No.		Km from Bishkek	Distance from carriage-way to receptor (m)	Measured Average Noise level, dBA.							
				2013	2015			2017			Day-time
				Field Measurement	Aver-age	08.00 to 11.00	17.00 to 19.00	Aver-age	08.00 to 11.00	17.00 to 19.00	KR MPL (Leq)
11	Sadovoye village School, no number,	37.4	10		77.75	74.5	81	62	63	61	**55**
12	Belovodskoye, Market	43.0	1	72							**55**
12A	Belovodskoye, Dwelling house (201 Frunze St.)	42.45	10	63	77.25	80.5	74	69	68	70	**55**
13	Petrovka village, Residential district, 504 Tsentralnaya St	51	8		75	78	72	70	63	77	**55**
14	Poltavka village, Secondary school, no number	55	30	62	71.5	71	72	69	69	69	**55**
15	Petropavlovka village, Secondary school	57.1	8	58	73.5	75	72	60	56	64	**55**
16	Novonikolaevka village, Secondary school	59.550	22	62	71.15	71	71.3	63	63	63	**55**

Sources: Consultant's field measurement, 05/2015; Traffic volume data are consultant's counts and estimates. Note: It is standard practice to add 10dBA as a night-time annoyance factor due to low ambient noise levels. The data in the table have not been adjusted.

II. Noise Modelling Result (Baseline)

148. The noise modelling work (was initially completed using observed (avg. 80 kph) instead of design speed data, resulting in large exceedances of Kyrgyz and IFC/World Bank standards (See Annex for full Hagler-Bailly Pakistan 2018 report).

149. The baseline noise levels already exceed the Kyrgyz and IFC day and nighttime limit by an average of 13 dBA and 17 dBA, respectively. For compliance purposes, it would be appropriate to use IFC guideline of baseline + 3 dBA.

150. 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. This approach was taken since the predicted baseline and construction period noise level differences were insignificant.

151. In December 2017 IPIG, with input from ADB, requested new modelling runs but using a 60kph speed throughout for the construction and operating periods (with exception of a short 80kph section at the start of the road) as well as the testing of the application of noise attenuating asphalt pavement (suggested by the CSC as well as the special noise consultant).

D. Vibration

152. Vibration measurements were taken in 2013 at 21 sensitive locations along the road, and stretching for >70 km The results of measurements showed that the vibration levels fluctuated considerable and seemed to be controlled by the type and weight of the vehicles passing. Unfortunately the vibration measurements were made using dB units of measure, which is convertible to ppv but remains inaccurate and could suggest unverifiable conditions (Table 21).

153. Vibration measurements were carried out by means of the following device.

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

Table 21. Vibration Measurement Results 2013

No.	Location	Nature of Vibration: By spectrum: Wideband	Tonal	By temporary: Constant	Fluctuating	Intermittent	Impulsive	Octave-band vibration pressure level (dB) with mean-metric frequencies (hz)		1,0	2,0	4,0	8,0	16,0	31,5	63	Sound level (dBA)	
	Bishkek – Kara-Balta																	
	Novonikolaevka (school), km 59	+				+					86	74	67	68	65	66	85	Actual
16																		
	Petropavlovka (school), km 57	+				+					87	78	69	66	65	66	88	Actual
15																		
	Petropavlovka (	+				+					83	80	71	72	67	66	82	Actual

No.	Location	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		
14	school), km 55																	
10	Belovodskoe (Mosque)	+				+					80	87	65	66	65	67	93	Actual
12A	Belovodskoe (market)	+				+					88	87	78	71	68	66	97	Actual
10	Aleksandrovka (school)	+				+					88	77	70	69	68	65	98	Actual
8	Sokuluk (school)	+				+					76	70	82	87	67	66	91	Actual
7	Sokuluk (central market)	+				+					77	70	68	65	66	65	92	Actual
6	Shopokov town (school)	+				+					72	79	68	74	73	66	81	Actual
4	Voenno-Antonovka (Mosque)	+				+					79	63	71	64	66	68	88	Actual
3	Voenno-Antonovka (school)	+				+					74	73	75	73	71	72	90	Actual
1a	Novopavlovka (market)	+				+					70	79	72	73	77	80	80	Actual
1	Novopavlovka (school)	+				+					74	69	68	65	66	67	87	Actual

154. The results of field measurements showed that in 2013 vibration levels were not stabile. Further, the authors of the 2013 IEE concluded that the vibration measurements appeared to be excessive, far beyond what should be experienced from road traffic (Table 21).

I. 2017 Update

155. The vibration study (Glendining, 2018)[8],was undertaken between Dec. 2017 and March 2018 did not measure existing vibration levels but focused on construction related vibration, potential damage to roadside structures and testing and establishment of damage control measures. This study indicated that cosmetic damage was possible for structures built of adobe and within a 16m distance from the source, expressed as ground vibration at receptors exceeding peak particle velocity (ppv) of 3 mm/sec.). Mitigation measures designed to measure and prevent damaging ground vibrations from reaching dwellings, including the use of vibration meters and trenches to block ground vibrations, coming from vibratory compactors, reaching vulnerable dwellings.

[8] Glendining, Alec. 2018. Vibration Assessment Study, Bishkek_Kara Balta Road. Internal report with IPIG. 48 pgs.

156.

VI. ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

157. Based on the project description and the results of the field surveys, and current baseline information, environmental impacts were identified and described 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's area of influence, the environmental impacts are mostly confined to the construction stage. The main impact categories arise from the following activities: (i) construction works within or close to settlements (ii) site clearance activities result in loss of top soil and vegetation structures, (ii) aggregate sourcing, crushing of aggregates and asphalt and concrete plant operation. In the following chapters the impacts have been divided into design construction, and operating work phase.

A. Design Phase

I. Physical Environment

158. A large number of the potentially more significant impacts can be avoided by proper planning/preparation, including basic items such as ensuring that environmental clauses are in the contract documents and that the IEE and its EMP have been distributed to the contractor and other relevant agencies, as well as providing adequate briefing and training on how the EMP is to be implemented. For that reason 10 mitigative measures have been defined in the EMP, the most important being proper distribution of the assessment documents, inclusion of environmental specifications in the tender documents, environmental safeguards training of the contractor by CSC, and the preparation of a tree cutting and management plan defining the best way to cut the thousands of adult trees, then replant and maintain new ones.

159. **Noise and Vibration**- During the construction period noise was assessed via a modelling study that examined noise condition with and without construction equipment in operation and various combinations of equipment operating at the same time. For the operating period the noise study modelled the noise for three future periods based on traffic projections and the application of speed limits and noise-attenuating pavement as a means of mitigating a very noisy roadside environment.

160. The road design called for the placement of a granular road sub-base material. To meet design standards this material, once placed on the road, needed to be compacted using vibratory compactors. This was known to result in ground vibrations, which could be transmitted to any nearby building and potentially cause damage to foundations and walls. A vibration study was completed to set vibration damage threshold levels for low, medium, high risk building classes (as determined by the Project Proponent) based on recognised International Standards, and in relation to vibratory compactor operations and varying distances from dwellings. To assist with this work a set of vibration impact maps was prepared, defining contours where different level of damage was predicted.

161. **Uncontrolled Borrow Area Establishment**- The project calls for the use of six borrow areas, five of them being very large (many km long) sites in operation for many decades and fully approved by the District Authorities. All areas used by the contractor will be rehabilitated according to the specifications provided in the Borrow Pit Management Plan (Annex 10) included with the Contractor's, construction environmental management work plan (CEMWP), and included in the IEE package. The contractor will also be required to follow the steps as defined by KR Regulation, namely to obtain all required permits from local authorities for use of borrow pits and

disposal areas, get approval from regional departments of the State Agency for Environmental Protection and Forestry (SAEPF) and pass all necessary documents to MOTR, and obtain a license to extract aggregate materials from the State Agency for Geology and Mineral Resources. The main deliverable is the Ecological Passports which have been completed for the borrow site operations and the siting of the batch and asphalt plants, plus a definition of the maximum extractable volumes.

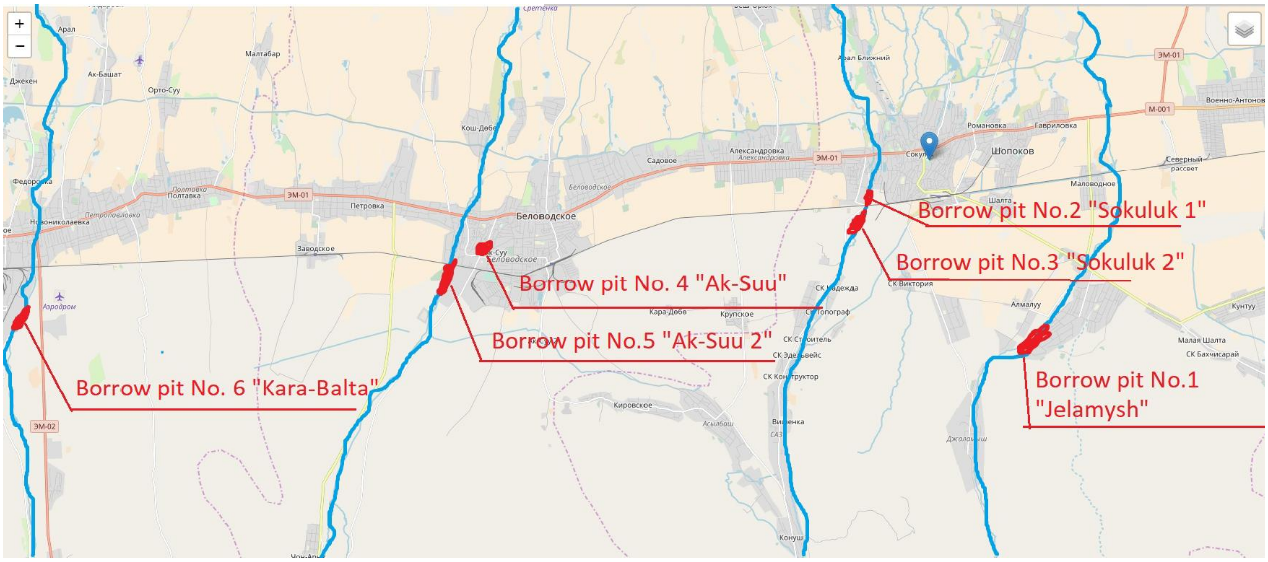

Figure 7. Location Map for borrow sites.

162. Unmanaged waste asphalt-concrete, concrete, temporary waste storage and processing areas - Large quantities of old asphalt pavement will need to be transported disposed of.

163. Prior to the start of the construction, and again in 2018, the contractor, worked with the local authorities, and identified 200 roads in 7 municipalities (Table **37**) that were interested in receiving the waste asphalt for local state-owned road repair. By July 2018 88 priority roads had been selected and the transport of materials was initiated. A special revision tto he SSEMP Annex 7 was completed (See Annex 4 of this IEE) defining the steps needed for asphalt placement that would lead to minimal environmental impact and few if any complaints by local people. Nearing the completion of the 88 roads , another set will be selected from the original 200 since well over 150,000 m^3 of waste asphalt will still need to be removed.

164. **Uncontrolled establishment of Asphalt and Concrete mobile batch plants.** Pavement material will be prepared at a single batch plants locate in the Sokuluk Borrow area about 9 km south from the project road at chainage km 42, where materials will be mixed, loaded onto trucks hauled to the work areas for placement. These facilities are noisy, dusty, and emit a strong odour of tar. To minimize impact on the general public this temporary operation is located more than 500m from any residential or public recreation area[9]. The aggregate is also sorted and crushed at this site, and dust suppression equipment (standard on most modern crushers) must be installed. The entire process of establishing a plant 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*

[9] A work camp for around 40 staff is located within 250m of the batch plant and 300m from the aggregate processing plant, operating from 0700 through 1800 six days a week and generating noise and dust that exceeds Kyrgyz and WHO standards.

of enterprises, structures and other facilities" and *Sanitary-epidemiological rules and standards. SanPiN 2.2.1/2.1.1.006-03*.

165. Further, the ecological passport report (extraction permit) for these operations has been completed, was approved in January 2018, and defines the location and extraction quantities of the operations.

166. **Material Haul Route Plan-** With more than 1.5 million m^3 of materials to be handled mostly by truck 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. Further, the contractor will arrange written agreements with local communities guaranteeing that damage to roads used to haul materials will be rehabilitated to pre construction conditions.

167. **Environmental Safeguard Implementation Training-** CSC will be required to have an environmental specialist on staff that will be fully familiar with implementation of EIAs, their EMPs 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 deliver 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.

II. Ecological Environment

168. 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.

169. Impacts on the ecological environment are minimal since the project activities will be mainly located on the existing RoW, specially selected temporary storage sites and the rivers crossed are intermittent and regularly experience mudflows. While the water quality for the parameters measured showed no appreciable contamination, it is highly likely that bacterial levels, from sewage and animal waste, are high and that other chemicals are present. The aquatic ecosystem consists of aquatic insects and common amphibians, habituated to the intermittent flows and long dry periods.

170. There are no special protected areas or biodiversity hotspot within 500m on either side of the alignment for its entire length.

171. **Tree Management Plan-** The most obvious ecological feature along the road is the extensive shelter and shade tree belt planted along both sides of project road for much of the road, starting at km 15.9 and extending t to the end of the work at Kara Balta (Figure 8). These are mature elm, poplar, cherry, oak and black locust trees 40-70 years of age

172. Not only do they provide shade during the summer and act as a windbreak during the winter bu trees sequester thousands of kg of CO_2 per year.

173. During detailed design the inventory of trees to be removed along the entire road was reduced from 11,000 trees to around 5000. The work on cutting down trees began in 2017, detailed information is provided below, Table 22.

Table 22. Tree Count for 2017 and 2018 Road Construction Sections

Section No.	Chainage (km)	Trees Removed 2017
2017		
1.1	15.9-23.3	746
1.2	35.5-40.58	621
1.3	45.6-51.6	1105
1.4	54.20-59.35	11052
	Total 2017	3524
2018		
2.1	21+300-35.5	No data yet
2.2	40+580-45.6	No data yet
2.3	51+600-54.2	1,070
2.4	59+350-60.92	300
	Total 2018	1370
	TOTAL	**4894**

174. Tree losses that are unavoidable (so far 4894 trees) will be compensated for by new plantations defined in replanting plans for each section (defined in an Annex to this IEE). Planting shall be conducted after technical works have been completed in a section of road (not waiting until the end of construction) and undertaken in the spring (March till April) and/or autumn (September till October) when trees have greatest chance of survival. The trees shall be planted at the spots where the tree losses have occurred and they will be planted according to the following parameters: >1.75 m height, age 5 – 7 years; Distance in between individual trees shall be 6 – 8 m; and the planted species will be *Juglans regia, Acer negundo, Ulmus carpinifolia, Populus alba, Salix alba, Robinia pseudoacacia*. Care will need to be taken to plant the 'right tree species in the right place', e.g., smaller trees under utility lines, reducing the need for heavy pruning, etc. Details are provided in the Tree replanting plans prepared by EPTISA, on behalf of the contractor.

175. The Tree Replanting and Management Best Practice Guide (Annex 10) includes instructions on planting procedures, location of nurseries and maintenance of newly planted trees by road section.

176. Additional potential impacts on the trees may include compaction of soil around and above the roots of the tree, and piling impervious material around the base of trees, as well as physical cutting of the root system. Mitigation of impacts to trees can be done through refraining from storing construction material and other heavy equipment near the roots, using only organic fill material at the tree base (drip-line) zone for potential fill, or fencing the area around the trees' 'drip lines' during construction works.

177. In July 2018 tree removal from both sides of the highway from change KM 21+300 to KM24+300 is planned. Prior to such removal an tree inventory and tree replanting plan was prepared in a manner similar to the four 2017 plans. The contractor has submitted and will continue to will submit this material to EPTISA for approval prior to the commencement of work. A letter confirming this requirement has already been sent to the contractor for all the 2017 tree removal and some of the 2018 work.

III. Social Environment

178. Social environmental issues arising during this stage are related to providing people friendly design features and considering uses of residents along the road. The following are the most important issues:

Figure 8: Elms, poplar and black locust trees lining Project Highway (now cut)

179. **Access Management Process During Road Construction-**This construction project involving the complete rebuilding of the highway, reconstruction of hundreds of large box culverts and all the bridges, will require detours, lane closures and access restrictions for local residents, e.g. intersections will be closed for some time. To minimize this inconvenience the CSC, working with the Police have implemented a protocol addressing how detours are established, what safeguards need to be in place, and how vehicles, pedestrians and livestock are accommodated during the work periods. This framework has been passed on to the contractor for implementation; which took place in September 2017. The information included staffing provisions for traffic management, consultation plan with local communities prior to work starting in an area and the sequence of rehabilitation after work is done with focus on re-establishing all weather access to at least preconstruction conditions.

180. The update of this IEE was completed almost 15 months into the construction period and the protocol for traffic management and lane diversions has been implemented. In general culvert construction is being done in a stepwise manner, namely first one side of the road then the other. Similarly road resurfacing is being done a lane at a time, allowing traffic to pass with minimum delay. Signage safety lighting and traffic control technicians are in place.

181. **Access and Severance-** Pedestrian crossings present a special problem as residences, commercial establishments and small industries occupy much of the roadside. People will need to cross the highway, a traditionally extremely dangerous action since there are few traffic lights and as such the movement of vehicles is erratic and at high speed. The width of the carriageway, in some places >35m, and is difficult

to cross. The solution will be either traffic lights that will require vehicles to stop, or at grade crossings with amber warning lights. At community consultations held by MOTR in 2015 and 2017, communities have made this known to IPIG and have indicate where improvements and additional crossing structures are needed. In response the following actions were taken by MOTR. The road designers have added 95 new marked at-grade crossings[10], 12 new signalled crossings and six underground pedestrian crossings (4 existing but needing major rehabilitation).

182. Other Road safety features such as, streetlights, traffic lights pedestrian crossing warning lights, and other visual means to reduce accidents will be installed along the road.

183. **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.

184. **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. Those that exist are in very poor conditions and provide little in terms of passenger safety and protection from the elements. To address this gap, MOTR is designing innovative bus stop, and is installing around 30 additional units along the road.

B. Construction Phase

185. The construction phase began in Nineteen potential construction period impacts are listed in the EMP tables (Table 25 and Table 26) addressing primarily the control of air and noise emissions through monitoring, proper management of earthworks, waste materials and contractor good-housekeeping practices associated with fuel and lubricant management, work camp waste disposal, and occupation health and safety practices for the contractors workforce. The following is a discussion of highlights of the details provided in the EMP

I. Physical Environment

(a) Air Quality

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

187. An air quality monitoring survey will be undertaken at the 13 sites identified in Table 15. The survey will be conducted quarterly with air quality and noise measurements taken at the same time for 1 hour at each site, i.e., at the receptor (sensitive structure) as pictured in Annex 2). The parameters to be tested will be: CO, NO, NO2, O3,SO2, PM10, PM2.5 VOC and noise.

188. **Carbon Monoxide (CO)**- 2017 measurements at the same locations and at approximately the same times, resulted in quite different results. All 16 stations had readings well below the 5 mg/m3 MPC.

[10] The consultant recommends that these 95 at grade crossings have amber warning lights indicating a pedestrian crossing

189. Since the only source of CO is from vehicle exhausts and given that that the sensitive receptor >30m from the Edge Of Pavement is most likely that the ready is an anomaly or sampling error, given that the sampling method involves collection in plastic bladder, transport to a lab and then analysis. All of 2017 sample collection was supervised in the field by EPTISA, and none exceeded the MPC level.

190. **Nitrogen Dioxide (NO2)**- For 2017 seven of the 16 stations had NO2 levels exceeding the MPC with the Novopavlovka Village market recording a 0.30 mg/m3 reading. The market sees a great deal of slow moving traffic transporting goods to and from the market and therefore higher NO2 level would not be unusual.

191. Further there was a direct correlation between distance from the edge of pavement and NO_2 levels.

192. **Sulphur Dioxide (SO_2)-** For 2017 levels were all below 0.005 mg/m^3 (Figure 13)..Ongoing construction period monitoring through 2018 should provide a better indication of local SO2 concentrations.

193. **Total Suspended Particulate Matter (TSP)-** The TSP measurements for 2017 continued to show elevated levels, exceeding the KR's MPL, linked in some sections of the construction zone to dust generated by the construction work.

194. Air quality impacts from asphalt plant, aggregate crushers, will be mostly dust emissions, and will be reported on once these facilities begin operation in May 2018. Ecological passports for their operation have been completed and approved, therefore requiring operations with Kyrgyz standards.

195. The following mitigation measures will be implemented by the contractor to reduce emission levels of construction equipment: (i) maintenance of construction equipment in good condition and avoiding, as much as possible, idling of engines; (ii) banning of the use of machinery or equipment that cause excessive pollution (e.g., visible smoke); (iii) the contractor should utilize construction machinery with low emission levels and iv) all construction vehicles will be shut down if not operating or left unattended for more than 3 minutes.

(b) Noise

196. Construction noise will generally be masked by the noise generated by the high traffic volume along the road. Field measurements taken between 2013 and 2017 indicated the traffic alone results in exceedances of noise standards defined by KR as well as IFC (adopted by ADB) by 15 and 17 dBA for day time and night time respectively; along much of the road. The contribution of construction operations was estimated to be between 1.5 and 5 dBA for typical equipment operation, occurring for 90% of the time and up to 8 dBA if the maximum pieces of equipment are operating at the same time (<10% of the work period). Although this condition is temporary, the following mitigative measures will be applied:

197. **Construction Period Noise Management**. Many noise issues can be avoided by planning the construction activities in a manner that minimizes the disturbance to the community. The measures to be taken will be:

i. Instructing the contractor to use newer equipment, as newer equipment is generally quieter because of technological advancements, and lack of wear and tear, worn out, loose, and damaged components.

ii. Locate storage area and vehicle yards in a manner that minimizes the travel time for construction vehicles.

iii. Pay attention to equipment at a particular location. By careful planning the number of machines/equipment operating at a specific location at the same time, noise exposure can be reduced to the extent that compliance with the noise criteria is achieved.

198. **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. This will include:

i. Avoiding using equipment with high intrinsic noise levels (amounts to disallowing old equipment and those with poor maintenance)

ii. Installing 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.

iii. Noise shields, physically attached to the piece of equipment, shall be provided to stationary equipment.

iv. 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.

199. **Equipment Operator Training.** According to US Federal Highway Administration (FHWA) Circular ,11 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. Therefore:

i. The contractor will maintain a training plan for all equipment operators that, among other will, shall also include techniques for reduction in noise.

ii. No operator shall be allowed to operate an equipment, unless he/she has received training on its operation.

200. **Night Construction and Distance Attenuation**.- construction takes palce between 0800 and 1800 six days a week,and night time operations are not allowed.

201. . Construction stage noise monitoring is ongoing and details are summarized in the EMP and the Annex 6 The Noise Management Plan.

202. **Temporary Haul Road at Km 17.-** The construction of a temporary 2 km long haul road in April 2018, built to bypass a newly construction section of the regional highway has resulting in complaints and damage to the land and pollution of the air and noise environmental for local communities within this road corridor (formerly a

[11] 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.

narrow farm track and transmission line service road). The CSC's safeguard team visited the area several times and the following impacts were identified.

Figure 9. Illegal haul road under construction (04/2018) along old farm track and transmission line access track.

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- Old asphalt pieces were placed on the existing farm track (Figure 9) and extended at least 2 m into the farm fields no either side;

- The traffic through a small community generates noise, dust, vibration and safety concerns since local people are unaccustomed to having high volumes of traffic through their communities;

- The placement of the old asphalt did not consider surface drainage and surface flow issues, such as poor drainage are possible;

- The narrow track contained shrub and tree windbreaks which were buried by the work.

203. On May 23rd, 2018 an inspection visit by the government, local authorities and EPTISA of the road, agreed that established that this new road passes too close to residences and would raise significant, noise, dust, vibration and traffic safety issue. Therefore the road was closed to through traffic, however remains as a farm track for use by local residents.

(c) Vibration

204. Given the project road's roughness, the high traffic volume with a large percentage of truck movements, vibration pluses causing at least cosmetic cracking of buildings as far as 20-30m from the carriageway is likely. Baseline measurements were taken in 2013-14, reported significantly high ground vibration levels, but with the only known source being the heavy vehicle movements. Unfortunately the units of measure used during that sampling program were not compatible with PPV, so better use of these data was not possible.

2017-2018 Update

The specialist consultant carried out a study of construction vibration at dwellings alongside the Bishkek Kara Balta Road in order to determine the potential effect of the

vibration on nearby houses and potential means of mitigation to reduce the risk of damage.
Existing vibration monitoring data obtained at dwellings alongside the road have been reviewed and additional measurements of ground borne vibration from the roller and excavator have been obtained. A review has also been made of existing methods for calculation of vibration from ground preparation and compaction, and vibration damage threshold levels for low, medium and high risk building classes have been set, based on recognised International Standards.
The effectiveness of potential methods of mitigation of ground borne vibration from vibratory compaction were examined including the use of low vibration operation of the roller and the use of trenches, formed by over excavation of proposed drainage channels. It was concluded that both these options offered significant levels of mitigation, though further measurements would be needed prior to construction to confirm the effectiveness of the trench.

The results of the vibration monitoring were compared with predictions made using the vibration model developed by TRL. The comparison showed the model to over predict attenuation of vibration with distance and also to overpredict the mitigation which could be obtained using a lower amplitude of roller vibration. However whilst the model itself could not be used, empirical relationships of a similar nature, based on statistical analysis of the measured data were derived.

These relationships were used to predict vibration damage contours (cosmetic) for low, medium and high risk building classes for high and low vibration roller operating modes. These are the distances from the road beyond which the risk of vibration damage (cosmetic) reduces below 5% (for 95% prediction level), or 33% (for the 66% prediction level). The contour distances were set out in diagrammatic form for each of these modes and prediction levels.

For the high vibration operating mode, the predicted distance to the vibration damage contour for cosmetic damage to high risk buildings would be 38m. The addition of mitigation in the form of an over excavated drainage channel i.e. a trench, would reduce the vibration damage (cosmetic) contour distance to 17m.

In the case of the low vibration operating mode, the predicted distance of to the vibration damage contour for cosmetic damage to high risk buildings would be 24m. This would reduce to 11m, taking into account the use of a trench as mitigation.

An alternative approach to the assessment was also considered based on the premise that risk of cosmetic damage may an unavoidable consequence of the construction of the road and to instead set a threshold level at which minor structural damage might occur. This would be approximately double the threshold for cosmetic damage, and for high risk buildings would be 6mm/s.
For high vibration mode the predicted distance to the minor structural damage contour for high risk buildings would be 25m, reducing to 11m with the provision of mitigation. The equivalent distance predicted by the TRL method would be 22m, assuming no mitigation.
For low vibration mode the predicted distance to the minor structural damage contour for high risk buildings would be 16m, reducing to 8m with the provision of mitigation. The equivalent distance given by the TRL prediction would be 9m, assuming no mitigation.
Vibration measurement were carried out during the excavation of the prepared sub base. The results indicated that the distance to the high risk building class contour (cosmetic damage) was 5.2m. i.e where excavation e.g. of drainage channels, is carried out at distances any less than 5.2m from a high risk building there may be a risk of cosmetic damage.

In the final stage of the study the EPTISA CAD team plotted vibration damage threshold contours on mapping of the scheme to produce Plans which illustrate the risk of cosmetic and minor structural damage to high risk buildings alongside the road. These were also prepared.
The Table below provides a summary of the findings and guidance to contractors on roller vibration settings and distances from the roller at which there is a risk of cosmetic or minor structural damage at high risk buildings (adobe).

Roller Vibration Setting	**Mitigation Option**	**Vibration Damage Contour Distance (m)**	
		Cosmetic Damage	**Minor Structural**
High	No mitigation	38	25
Low		24	16
High	With Trench	17	11
Low		11	8

After careful consideration of effectiveness, cost, logistics and simple practicality this study was not used and MOTR decided to instruct the contractor to use only non vibrating rollers throughout the construction period.

(d) Surface and Groundwater Water

205. **Surface Water**- The road crosses several watercourses including natural rivers, flood control ditches and irrigation canals. The potential impacts on the watercourses include siltation, change of surface hydrology increased sediment load, and pollution from construction area runoff.

206. The impacts of stockpiling of topsoil and material are mitigated by storing the material at a safe distance from nearby surface waters and by providing for long term stockpiles a grass cover. These mitigation measures prevent also the impacts of increased sediment load on surface hydrology. Settling ponds must be constructed where silt-laden runoff water can reach streams to places where construction activities come near the natural watercourses.

207. When construction activities are being carried out on or in the vicinity of watercourses improper handling and storage of materials (concrete, asphalt, lubricants, fuels, solvents) may pose the risk of water contamination. In addition embankments and construction materials (fill, sand, and gravel) are subject to wash out with rainwater. Oil and grease concentrations in surface waters will increase especially if oil leaks from engines are not properly controlled. Appropriate mitigation measures will be taken, such as regular maintenance of the construction equipment to prevent oil leaks, in addition chemicals and oil will be stored in secure, impermeable, and bounded areas far away from surface waters.

208. While the risk of contamination is low, as work is planned during low or no flow conditions, a limited surface water quality sampling program will be undertaken, using the exist survey data collected in June 2015 as a baseline. Since the aquatic ecosystem does not exist in these streams where they cross the road, little damage is possible, however two parameters will be monitored, namely Oil and Grease and Total Suspended Sediment. This monitoring will take place only if work is done while there is water flowing in the watercourse. The sampling will involve taking samples upstream and downstream of the worksite while construction is ongoing and once construction is finished. The sampling will take place at all water crossing when a flow present and

works is being undertaken. By taking samples above and downstream of a work site, existing conditions and worksite pollution (if any) can be tracked.

209. **Groundwater** There is no available evidence to suggest that groundwater contamination from the work. This has not been confirmed by the contractor but Specific Environmental Management Plans (SEMPs) Annex 3 and 8 will be used to provide any further guidance if needed.

(e) Topsoil Protection and Erosion

210. 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.

211. 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.

212. 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.

(f) Contamination from Earthworks, Aggregate, Concrete and Asphalt plant

213. **Borrow Areas-** When planning to open a new borrow site, the contractor, working with the framework instruction provided as part of the mitigative measures documentation in the EMP and CEMWP, 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 Geology and Mineral Resources, prepare a «Borrow Pits Development and Restoration Plan" (CEMWP & SEMP Annex 14) 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. However, for the new site (No. 1) the contractor will need to prepare a site development and rehabilitation plan (based on guidelines provided in CEMWP-SEMP Annex 14), and which must provide 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, including necessary barriers at aggregate faces, fencing when needed and warning signage (especially at Site No. 1);
- expected quality of extracted materials;
- topsoil storage/protection and environment protection steps; and,

- rehabilitation of disturbed lands when site is decommissioned.
-

214. For existing sites the contractor will be required to rehabilitate and fully stabilize the area of the borrow site where material was extracted. For example to re-contour and stabilize all slopes and open aggregate faces.

215. To minimize dust the contractor shall develop a dust suppression program in accordance with SEMP Annex 11 Guide, 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. All trucks hauling materials will need to use covers for the load to prevent dust pollution. The air quality monitoring will keep a close record of dust (particulate matter) emissions.

216. In early 2017 six aggregate extraction site locations were identified and extraction approved by local authorities (Figure 7). Five of the six sites were decades old borrow areas with well-established access road network and working aggregate faces. Jelamysh, Site No. 1 is the only completely new site.

217. **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.

218. Two Ecological Passport documents, addressing this requirement and providing clearance to proceed were completed in January of 2018 and approved in March 2018. These are on file with IPIG, with copies to the contractor.

219. Since for this project, all construction materials processing is taking place at one location the SHZ is 500m.

(g) Recycling of Construction Materials

220. Recycled material from the existing pavement and special recycling techniques will be used in reconstruction of the pavement layers. The cost effectiveness of reconstruction measures could be enhanced greatly by the application of recycled pavement materials. Recycling options include hot mix recycling (HMR) with/without new materials and cold mixing recycling with/without new materials. Recycled material

will be used to the largest extent feasible to reduce the volume of spoils that needs to be disposed of.

221. Prior to commencing the activities, the contractor will submit revised earthworks calculations (adjusted from the data provided in the bid documents), focusing on the volume of old pavement to be excavated, stored, reprocessed and reused. Steps for the disposal of the unused asphalt-pavement will be included in the submission to CSC and will follow the guidelines provided on SEMP Annex 7.

222. **Waste Asphalt Placed on Rural Roads**-All the existing asphalt from the 45.5 km long by 20m wide asphalt lanes to a depth of 30 cm equals around 297,000.00 m3 of material to be disposed of. The contractor, IPIG and local authorities have agreed to dispose of this waste asphalt by placing it and crushing in on site on 88 nominated rural roads (Annex 4 of this IEE) within a few km of the construction corridor. The estimate total volume needed for the 88 road is approximately 142,650.00 m^3 of waste, leaving another 124,350 m3 of (minus around 30,000 m3 used as sub base material) to be dispose of. Given that the local authorities identified 200 roads reduced to 88, the remaining material can easily be disposed of.

223. The contractor has already started depositing waste asphalt on 11 roads and is closely adhering to the steps defined in the SSEMP Annex 7. The contractor is focusing on community consultation and having local officials on site to specify locations and oversee all deposits, crushing and grading of the asphalt-sub base mixture taken from the highway.

224. The literature suggests that lead could leach from waste asphalt exposed to the elements and especially first rain events after placement of material. To prevent any issues surface runoff from these roads will be diverted away from an groundwater sources, will be diverted over grassed ditches and four replicate sample will be taken from four roads and leachate will be tested for lead levels. If lead levels exceed Kyrgyz MPC, small detention areas will be establish to allow runoff water to collect in sumps and lead to settle out before discharge to a stream. These sumps will need to be cleaned and top soil layer containing lead, buried and disposed of in a landfill sites.

(h) Bridge/Culvert Rehabilitation

225. The water courses crossed by the highway bridges pass have only seasonal flows, one is a flood canal, another a mudflow diversion channel . Therefore the impact of bridge reconstruction should be minor, assuming good construction practices are used and the mitigative measures related to contractor good housekeeping as defined in the EMP and SEMP Annexes, 4,5,8 and 13 are strictly adhered to. These include handling of fuels and lubricants, sewage and garbage management and clearing of all debris from river channels as soon as construction is completed. Timing for total and partial reconstruction works should be during low or no flow periods, which are mid May through mid September.

226. **Culverts -**approximately 204 culverts require cleaning, but mostly repairing, reconstruction and replacement. The new or repaired culverts will have to have sufficient diameter to prevent blocking, as well as being long enough to accommodate the additional carriageway lanes. Additionally, at the detailed design stage the CSC will take into account the requests of local community to install additional culvert crossings to improve irrigation and drainage of accumulated surface waters.

227. The environmental impacts associated with this work can be minimized if culverts are rebuilt properly, i.e., properly sized and with the correct slope, downstream erosion/scour protection measures applied and adequate downstream drainage

conveyance provided. Culvert work should also takes place during the dry season, since otherwise temporary flow diversions will be necessary. A number of culverts convey irrigation water for irrigation purposes and therefore flow must not be diverted. In these situations, the contractors will need to liaise closely with farmers to establish times when work can take place and not harm crop development.

228. Nearly all structures will be concrete box culverts, most precast, with each section set in place and sealed with a special commercially available gasket/sealant material. Work will be done in two parts so that the highway remains passable at all times.

(i) Contractor Good Housekeeping

229. 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 clean up is not underway within 12 hours of detection. 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.(this has already occurred twice during the start of the 2018 construction season).

(j) Occupational Health and Safety

230. For health and safety protection of workers and adjacent communities, the following shall be provided/secured by the contractor:

1. Adequate health care facilities (including first aid facilities) within construction sites;
2. 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;
3. Provision of personal protection equipment for workers, such as safety boots, helmets, gloves, protective clothing, goggles, and ear protection in accordance with KR legislation;
4. Potable drinking water to all workers;
5. Adequate protection to the general public, including safety barriers and marking of hazardous areas;
6. Safe access across the construction site for people whose settlements and access are temporarily severed by road construction;
7. Adequate drainage throughout the work camps so that stagnant water bodies and puddles do not form;
8. 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.
9. Where feasible the contractor will arrange the temporary integration of waste collection from work sites into existing waste collection systems and disposal facilities of nearby communities. This shall be taken into consideration when deciding the place for the camp. The contractor will arrange for extra payment if community services are to be used.
10. 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.

11. The contractor shall provide information to workers, encouraging changes in individual's personal behaviour 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.

(k) Operation and Management of Construction Camps[12]

231. The following specifications are supplemental to the guidelines provided in SEMP (Annexes) No. 3 and 4, prepared by the CSC for use by the contractor. Living conditions in work camps are frequently far below basic standards and to that end the following specifications are provided Since the contractor has three operating camps these specifications are important to implement immediately and maintain throughout the construction period.

232. The specifications focus on hygienic conditions, clean food preparation and eating places, potable water supply separation of toilet and washing facilities, adequate lighting, ventilation and heating

233. **Worker Good Health and Safety** The requirements for good quality workers accommodation and the right to health and safety protection are well established in international contract templates and implementation guides, including ADB's SPS 2009 (Appendix 1, Sect. 10) and FIDIC's Pink Book. The Pink Book 's Section 6.7 is clear in its commitment to both worker rights and health and safety and the government and donor assume that the contractor understands this.

234. Kyrgyzstan is a member of the International Labour Organization (ILO) and as such is committed to enforcing, with all its contractors, minimum ILO accommodate, health and safety in the workplace standards.

235. The International Finance Corporation (IFC) and European Bank for Reconstruction and Development (EBRD) published a policy and guidance [13], revised on 2012 and available in Mandarin Chinese and Russian. The contractor must apply these standards. Most significant elements are camp:

1. Workspace
2. Fire protection
3. Lavatories and showers
4. Potable water
5. Clean food preparation and eating areas
6. Lighting

[12] Much of the text in this section was copied from the audit note prepared by the ADB's Int'l Environmental Consultant as part of the construction camp condition report.
[13] https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/policies-standards/ehs-guidelines

7. Safe access
8. Air supply
9. Noise and vibration

236. As a way of saving money, contractors often convert steel shipping containers to living accommodations. Any such accommodations must be outfitted properly, provide comfort during both summer and winter conditions, and allow for space per resident of between 4.0 and 5.5 m^2, and that the distance between beds is a minimum 1m. In cold climates shower and toilet facilities should be in the same structure as sleeping and living quarters[14].

237. For camps planned at locations where distance to community facilities is more than 300-500m the contractor must make available reasonable community facilities, including a retail outlet for worker to purchase personal necessities, or provide regular complementary transport to local community facilities/stores.

238. Using these guidelines, SEMP Annex 3 and 4 of the IEE's Best Practice Guidelines and the IFC's Pink Book guidelines the contract is required to prepare a camp operations plan addressing, as a minimum the nine items listed above. This plan must be prepared within two weeks of the receipt of this final IEE and/or instructions from CSC, and submitted to the CSC.

(l) Access and Severance

239. See paragraph 181 and 182. The CSC will also monitor this continuously and enforce these measures at all times.

II. Ecological Environment

240. Given the project work area is within the RoW of an existing Class 1 highway, 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, as well as careless digging and compaction around remaining trees exposing roots and reducing water penetration to the roots.

241. Any trees damaged during construction regardless of whether it is the contractor or a subcontractor, the contractor must organize to replace and maintain the tree(s), with saplings >5 years old.

III. Social Environment

242. **Traffic and Congestion**- Traffic impacts of the road rehabilitation project will include disturbance of traffic along the road sections. Prior to commencing operations the contractor will review the material prepared by the CSC and shall discuss and agree to a traffic management procedure to local traffic authorities, should attempt to provide information to the public about the 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 signalling as required.

243. Pedestrian Crossings-see above

[14] A recent inspection of the contractor's camp at Ak Suu showed that the containers are fitted with four beds per container allowing for just over $2m^2$ per person and no space between beds, therefore fully non-compliant and in fact are suited for one person per container. The accommodations must therefore equal the number of workers.

244. **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.

245. 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; and
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.

C. Operation Phase

I. Physical Environment

(a) Air Quality and Noise

246. **Air Quality**- The proposed project will result in better road condition, increased speed of vehicles, and the increase of traffic volumes along the Bishkek – Osh road. This is a function of the growth rate and vehicle ownership in the country, not the widening of the road. The project road is the only N-S highway and as such diversion is not possible.

247. The air quality in the project corridor airshed is significantly polluted (Table 18). That being said, the traffic volumes are projected to grow by 7% per year for passenger vehicles and 4% per year for trucks and buses. With a projected traffic volume increase by 2020 of 10,000 vpd will come the elimination of older more polluting vehicles from the fleet, fewer vehicle stops and starts due to better road conditions, better traffic management, better engine technology and vastly more fuel efficient vehicles. Further, KR is planning to import better-refined fuels with lower emission factors per liter used.

Table 23. Traffic projection (AADT) by sub-sections

	Bishkek-Kara-Balta			
Year	Km 08-17	Km 17- 29	Km 29-40	Km 40-61

2013	41,996	48,558	22,832	12,507
2018	49,398	57,117	26,856	14,711
2020	55,348	63,996	30,091	16,483
2030	65,103	75,276	35,395	19,389
2038	65,103	75,276	35,395	19,389

Source: Kock's Consultant's 2013 estimations

248. **Noise -**The noise survey completed in June 2015 (Table 21) 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. Nearly all the estimated construction period noise levels, as modelled by the Hagler Bailey (2018) exceed Kyrgyz standards, but remained within the IFC+3dBA formula. Noise levels that interfere with sleep and impact schools and hospitals now exist along the road. Mitigation during this period is limited since the source is traffic and the major mitigative actions of noise reducing pavement and speed controls will only be applied once the work is done.

249. **Predicting Future Noise Conditions-** Using vehicle fleet traffic projections and annual growth rates provided in project documents a specialist noise consultant (Hagler-Bailley, 2018) made noise projects for 2025, 2030 and 2035 using the SoundPlan modelling software. The entire 45 km of road and roadside buildings were digitized. Then the IFC baseline +3 dBA standard was applied to all 4,370 dwellings along the road to establish which ones exceeded that standard. Even without mitigation only four dwellings exceeded the IFC+3dBA standard during the day and 135 (these were all identified by lat and long coordinates) during the night[15] (see Hagler Bailley, 2018).

250. The mitigative measure using a noise attenuating asphalt formulation (asphalt concrete 0/11 without gritting (void % 7-8%) as well as porous asphalt; pores >15% 0/11 was modelled and all dwellings were found to be in compliance wth the IFC + 3dBA formula. It was also found that management of speed limits to ≤ 70 kph, and preferably 60 kph would also stabilize these levels. Therefore, the noise attenuating asphalt concrete formulation as defined above is being developed and will be applied to the road.

251. In addition, noise testing will take place at the same sites in 2018, as used during the 2015 and 2017 surveys. The measurements will be taken 2x/month for a six-month period during year 1 of the operating period. The resulting date will be used to determine how well the noise-attenuating pavement actually reduced the noise levels.

(b) Soil and Erosion Control

252. The contractor is required to complete all measures defined in the EMP, and do this before the CSC's environmental specialist completes a post-construction safeguards audit. Confirming that topsoil placement, landscaping and planting have been completed and active maintenance is taking place will be essential. 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

[15] At the start of the project all construction at night was forbidden, but due to the long construction delays this regulation is being reconsidered by MOTR. No directive has yet been issued but noise projections were made just in case night time construction will be permitted.

rock gabions, should be installed (See Best Practice Guideline (SEMP) Annex 13 of the IEE documentation).

253. 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. To that end the contractor is preparing a culvert inventory that will provides a photo of each culvert and its condition before and after construction.

254. MOTR will instruct the contractor to complete this work during the one-year defect period.

II. Ecological Environment

255. The only ecological issue that could arise during the operating period is a failure to properly maintain the large tree plantations, and also inappropriate landscaping. 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 is home to many thousands of creatures, mostly insects and birds and is an open forest-track ecosystem. 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 IEE, cutting should be minimized to the greatest extent possible by using innovative designs that build the trees into the road structure.

III. Socio-Economic Environment

256. **Pedestrian safety**- At present the road provides few safety features for pedestrians. Crossing is extremely dangerous, with many pedestrian accidents were recorded in the past (2013-2015 Highway Police records). To improve pedestrian safety 96 pedestrian crossings, 12 signalled intersections and six underpasses will be brought into service along the 45 km road. Livestock crossings are not anticipated.

257. **Resettlement -** The rehabilitation of the road will be done using the existing RoW so there will be no need to demolish any residential houses. People are not living within the RoW, but operating their business and their enterprises within the RoW. Therefore there will be significant losses to businesses, markets, assets and livelihoods, which need to be compensated. The consultant is now undertaking the Land Acquisition and Resettlement Plan covering assessment of loss and compensation procedure. This will be reported in a separate report.

D. Benefits

258. The project will generate many benefits, and the five 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 pedestrian crossing facilities.

E. Construction Action Plan (CAP)

259. Between March 2017 and June 2018 the CSC sent 30 non-compliance or environmental safeguards warning letters to the contractor (Table 24). The CSC has conducted at least weekly follow up inspections and has instructed the contractor to take prompt action to correct the problem. 25 of the 30 issues are being resolved, but slowly.

260. The issue remains that responses by the contractor are often vague and lack the detail to determine if the mitigation has actually taken place. To address this, the CSC has provided a template of the format of acceptable contractor responses, but to date this have not been adopted. In July 2018 a meeting was organized with the contractor and the reporting requirement were specified once again and the report template distributed once again.

261. More than thirty non-compliance notices since the start of construction, without significant reduction in 2018 is unacceptable. The CSC's notices, weekly field inspections, and discussions with the contractor seem to achieve only marginal success.

262. The consultant collaborates with the contractor to eliminate violations, and also explains to the contractor the requirements for environmental protection, to prevent such violations.

Table 24. Environmental Non-compliance and related notices sent to Contractor and follow-on Actions: March-June 2018

No.	The problem of non-compliance, defined by EPTISA (e)	CEMWP ref. Number & Date and Ref. No. of notification to Contractor	Applicable SEMP Guide on Best Practices (No.)	Specific issue and location	Actions taken by the Contractor	Date	EPTISA Inspection
1e	**The problem of disposal of old asphalt**	**CEMWP № 2.6.1.** EP-CR5-HN-303, from 22.03.2018	Annex 7. Old Asphalt Management Plan	Lack of coordination with environmental authorities. In many places pieces of asphalt are laid outside the road on private lands.	Approvals are received. The pieces of asphalt are removed from a private area	26.03.2018 02.04.2018	04.05.2018 compliance uncertain and conflicting results
2e		**CEMWP № 2.6.1.** EP-CR5-HN-407, from 04.05.2018	Annex 7. Old Asphalt Management Plan	The stock of asphalt piled on the roadway is not leveled by blocking the passage for vehicles. Road transport on this road is forced to travel around heaps of asphalt through private fields by damaging crops	No action taken		07.05.2018.
3e		**CEMWP № 2.6.1.** EP-CR5-HN-413, from 07.05.2018	Annex 7. Old Asphalt Management Plan	The road is blocked by the stock of old asphalt piled on the roadway. The situation only worsened, as the area of damaged crops increased.	Asphalt was leveled. The planning of the territory was carried out	9 -10.05.2018	10.05.2018
4e	**The problem of disposal of construction and household waste**	**CEMWP № 2.6.2.** EP-CR5-HN-303, from 22.03.2018г	Annex 5 Waste Management Plan	At the construction site of the bridge across the Jelamysh river there is construction waste			24.03.2018 No action yet
5e		**CEMWP № 2.6.2**. EP-CR5-HN-303, from 22.03.2018	Annex 5 Waste Management Plan	On the territory of the camp in Sokuluk village found a lot of construction and household waste, empty barrels, old tires. Expired fire extinguishers are found	The territory of the camp is brought to the proper condition.	26.03.2018	29.03.2018
6e		**CEMWP № 2.6.2**.	Annex 5 Waste	On the territory of the camp in	The territory of the	30.03.2018	02.04.2018

No.	The problem of non-compliance, defined by EPTISA (e)	CEMWP ref. Number & Date and Ref. No. of notification to Contractor	Applicable SEMP Guide on Best Practices (No.)	Specific issue and location	Actions taken by the Contractor	Date	EPTISA Inspection
		EP-CR5-HN-303, from 22.03.2018	Management Plan	Belovodsk village, there are no garbage cans, waste containers are full, the wastewater storage is full, it is necessary to pump out sewage.	camp is brought to the proper condition.		
7e		**CEMWP № 2.6.2**. EP-CR5-HN-303, from 22.03.2018	Annex 5 Waste Management Plan	On the installation area of a stone-crushing plant, an asphalt-concrete plant and a concrete batch plant, the barrels with bitumen are stored on non-equipped site that is not concreted, without shelter. Empty barrels, construction waste were found.	Barrels with bitumen are installed on pallets, covered with waterproof canopy	27.03.2018	29.03. 2018
8e		**CEMWP № 2.6.2**. EP-CR5-HN-364, from 18.04.2018	Annex 5 Waste Management Plan	At the construction site of the bridge across the Jelamysh river surplus construction soil deposited on a slope on the north side of the road.	Soil removed from the slope side of the road	24.04.2018	25.04.2018
9e		**CEMWP № 2.6.2**. EP-CR5-HN-364, from 18.04.2018г	Annex 5 Waste Management Plan	On the north side of the road Section 3, the installation of culverts has been completed, but in many places, there were not removed reinforced concrete wastes formed during the dismantling of old pipes.	All reinforced concrete wastes exported to a special site, allocated by the Road and Operational Enterprise.	24.04.2018	25.04.2018 Mitigation measure being implemented
10e		**CEMWP № 2.6.2**. EP-CR5-HN-364, от 18.04.2018г	Annex 5 Waste Management Plan	The removed asphalt is transported to the country road (alternative), In many places pieces of asphalt are laid outside the road on private lands.	The pieces of asphalt that are located outside the road are removed. Slopes are planned.	9 -10.05.2018	10.05.2018 No resolution yet
11e	**Living Conditions for Workers**	**CEMWP № 2.9.4** EP-CR5-HN-364,	Annex 4 Management	In the residential area of the ACP electrical wiring in many places is	Two workers live in residential premises	24.04.2018	25.04 2018 Implementatio

No.	The problem of non-compliance, defined by EPTISA (e)	CEMWP ref. Number & Date and Ref. No. of notification to Contractor	Applicable SEMP Guide on Best Practices (No.)	Specific issue and location	Actions taken by the Contractor	Date	EPTISA Inspection
		from18.04.2018	Plan For The Life Of The Construction Camp	made with violations. In the shower room, electrical outlets are installed with violations, next to the shower mixer and sink, there are no hangers for personal belongings. The gas cylinder is located in the kitchen, which is dangerous. The living quarters are overpopulated. In a room of 8 square meters live 4 people. In the room there are no tables, cabinets for personal things, so personal belongings lie on the floor or on the beds.	with an area of 8.5 m. The kitchen is equipped with a refrigerator and all necessary household items. A summer playground for workers' meals is arranged, where workers can spend their free time after work. Women's and men's shower rooms are equipped. Made toilets, wash basins. In the kitchen and living areas there are fire extinguishers, 2 fire shields are installed.		n taking place slowly
12e		**CEMWP № 2.9.4** EP-CR5-HN-364, from 18.04.2018	Annex 4 Management Plan For The Life Of The Construction Camp	Contractor's camp in the Belovodsk village Living premises for workers need cosmetic repairs. It is necessary to whitewash, additional lighting is also necessary. For local workers, it is necessary to arrange a room for eating. On the territory of the camp it is necessary to clean up the garbage.	It is established that cosmetic repairs have been carried out in the residential premises. The walls are whitewashed, the electrical wiring is isolated, the lighting lamps are replaced with more powerful ones. A shower room, wash basins are made.	24.04.2018	25.04 2018 Mitigation taking place

No.	The problem of non-compliance, defined by EPTISA (e)	CEMWP ref. Number & Date and Ref. No. of notification to Contractor	Applicable SEMP Guide on Best Practices (No.)	Specific issue and location	Actions taken by the Contractor	Date	EPTISA Inspection
					Toilets are whitewashed, lighting is replaced. Kitchen is also whitewashed, refrigerators are installed, white coat for cooks are purchased. The territory of the camp is cleared of debris. Trash bins are installed. In the kitchen and living areas there are fire extinguishers, a fire shield.		
13e	**Tree Management**	**CEMWP № 2.5.1**Tree management EP-CR5-HN-303, from 22.03.2018	Annex 10 Tree Management Plan for Sections 1-4	On Section 1 there are trees, the trunks of which are covered with construction materials.	Trunks of trees are cleaned of construction soil It is necessary to obtain all approvals for cutting down trees	26.03.2018	30.01.2018
14e		**CEMWP № 2.5.1** Tree management	Annex 10 Tree Management Plan for Sections 1-4	On Section 1, the Contractor plans additional cutting of trees. It is necessary to justify the reason for the additional tree cutting	Trunks of trees are cleaned of construction soil It is necessary to obtain all approvals for cutting down trees	24.04 2018	25.04.2018
15e	**Borrow pits**	**CEMWP № 2.7.4** EP-CR5-HN-384 from25.04.2018 EP-CR5-HN-397 from 03.05.2018	Annex 14 Borrow Pit Management Plan	The development of the Jelamysh borrow pit began with a violation of the project, which the Contractor repeatedly warned against in writing. Considering the fact that the borrow pit field of the Jelamysh borrow pit is located on a slope, the			

No.	The problem of non-compliance, defined by EPTISA (e)	CEMWP ref. Number & Date and Ref. No. of notification to Contractor	Applicable SEMP Guide on Best Practices (No.)	Specific issue and location	Actions taken by the Contractor	Date	EPTISA Inspection
				development of the field should have been done layer by layer with 5 m ledge starting from the upper area. In fact, the development of inert materials in the borrow pit was carried out from the lowest point with a height of the ledge of more than 10 m in violation of design decisions and safety precautions; - When preparing the site for storing the sifted material, the soil layer was not removed.			
16e	**Worker's camp on the territory of the Camp**	**CEMWP № 2.9.4** EP-CR5-HN-436 from 16.05.2018	Annex 4 Management Plan For The Life Of The Construction Camp	In the camp of workers' residence, food waste is thrown into the installed metal garbage containers in an open form, which becomes an ideal breeding ground for parasites and results a threat to the health of the living workers			05/21/2018 everything remained unchanged
17e	**Bridge on the Sokuluk river**	**CEMWP № 2.9.4** EP-CR5-HN-436 from 16.05.2018	Annex 13 Environmental Protection Plan for the Construction and Reconstruction of Bridges	Metal fencing during the construction of the bridge over the Sokuluk River, made of metal pipes does not ensure the safety of pedestrians	It is necessary to add to the fencing of the bridge an additional metal bars or metal mesh		30.05.2018 Fencing is done
18e	**Territory of construction of asphalt-concrete plant**	**CEMWP № 2.9.4** EP-CR5-HN-439 from 17.05.2018	Annex 5 WasteManagementPlan	In the territory of the asphalt-concrete plant construction, a large quantity of bitumen in plastic packaging was delivered. Bitumen	It is necessary to remove the bitumen from the ground. Install packages with bitumen	№220-020 From 20.05.2018	05/21/2018 Packages with bitumen are partially

No.	The problem of non-compliance, defined by EPTISA (e)	CEMWP ref. Number & Date and Ref. No. of notification to Contractor	Applicable SEMP Guide on Best Practices (No.)	Specific issue and location	Actions taken by the Contractor	Date	EPTISA Inspection
				was unloaded to the ground without observing environmental measures. At visual inspection it is established that some packages were damaged during unloading, as a result of this, bitumen was released to the ground. Approximate weight of leaked bitumen is more than 600 kg	on a solid foundation under a canopy		removed to polyethylene litter and covered with polyethylene. The contractor plans to finish the work by 25.05.18
19e	The problem of transportation of a borrow pit material	CEMWP № 2.9.2 EP-CR5-HN-440 от 18.05.2018	Annex 14 Borrow Pit Management Plan	The road proposed for the transportation of borrow pit material does not meet the safety requirements	It is necessary to determine on what road to transport the borrow pit material	C-055 from 22.04.2018 EP-CR5-HN-368 of 19.04.2018	
20e	Tree management	CEMWP № 2.5.1 Tree management EP-CR5-HN-467, of 25.05.2018г	Annex 10 Tree Management Plan for Sections 1-4	On Section 1 there are trees, the trunks of which are covered with construction materials.	Trunks of trees are cleaned of construction soil	29.05.2018	30.05.2018
21e	The problem of recycling of construction and household waste	CEMWP № 2.6.2. EP-CR5-HN-467, of 25.05.2018г	Annex 5 Waste Management Plan	On Section 1, during the construction of culverts, there are construction waste	It is necessary to remove construction waste from the site		30.05.2018г Construction waste partially removed
22e	The problem of transportation of a borrow pit material	CEMWP № 2.9.2 EP-CR5-HN-468, of 30.05.2018г	Annex 14 Borrow Pit Management Plan	Determination of the route of transportation of a borrow pit material	Determination of the route of transportation of a borrow pit material	№ 201 – 149 Of 22.05.2018г	23.05.2018
23e	Recycling of old asphalt	CEMWP № 2.6.1. EP-CR5-HN-487, of 01.06.2018г	Annex 7. Old Asphalt Management	Getting approval for the export of asphalt to rural streets	The approval is given, under condition of crushing of asphalt on	№C-070, of 29.05.2018	30.05.2018

No.	The problem of non-compliance, defined by EPTISA (e)	CEMWP ref. Number & Date and Ref. No. of notification to Contractor	Applicable SEMP Guide on Best Practices (No.)	Specific issue and location	Actions taken by the Contractor	Date	EPTISA Inspection
			Plan		pieces no more than 20x20		
24e	Recycling of old asphalt	CEMWP № 2.6.1. EP-CR5-HN-540, of 22.06.2018	Annex 7. Old Asphalt Management Plan	The removed asphalt is exported to a country road, A large amount of asphalt is transported to the road and not planned.	In the established time frame nothing was done.	The contractor is warned that in case of failure to perform until 26.06, all work will be stopped	25.06.2018 27.06.2018г Warnings are eliminated
25e	**CEMWP № 2.6.1.** **disposal of old asphalt**	№205-003, from 24.04.2018	Annex 7. Old Asphalt Management Plan	Approval for the export of asphalt to rural streets	The approval is given, provided the crushing of asphalt into pieces no more than 20x20	EP-CR5-HN-417, from 08.05.2018	
26e	**CEMWP № 2.7.4** Development of the Jelamysh borrow pit in accordance with the project	№220-022 from 21.05.2018	Annex 14 Borrow Pit Management Plan	Approval for the development of a borrow pit	Permission to develop a borrow pit was given	EP-CR5-HN-461, from 24.05.2018	
27e	**CEMWP № 2.9.2** The problem of transportation of a borrow pit material	№ 201 – 149 from 22.05.2018	Annex 14 Borrow Pit Management Plan	Determination of the route of transportation of a borrow pit material	Search for a new route for the transportation of borrow pit material		
28e	**CEMWP № 2.6.1.** Recycling of old asphalt	№C-070, of 29.05.2018	Annex 7. Old Asphalt Management Plan	Getting approval for the export of asphalt to rural streets	The approval is given, under condition of crushing of asphalt on pieces no more than 20x20	EP-CR5-HN-487, от 01.06.2018	

No.	The problem of non-compliance, defined by EPTISA (e)	CEMWP ref. Number & Date and Ref. No. of notification to Contractor	Applicable SEMP Guide on Best Practices (No.)	Specific issue and location	Actions taken by the Contractor	Date	EPTISA Inspection
29	**Tree Management**	EP-CR5-HN-559	Annex 10 Tree Management Plan	Tree inventory and preparation of tree management plan not complete and contractor wants to cut trees	Request approval	27,06.2018	Permission refused until inventory, mapping and tree replanting plan submitted to EPTISA

263. All 29 non-compliance issues (Table 24) have been followed up and oral and written instructions on corrective actions have been provided to the contractor, in many cases several times, e.g. related to work camp operations, bitumen storage areas and dust control. IN addition the CSC national environmental consultant is conducting weekly inspections and preparing monthly monitoring reports with photos.

VII. ENVIRONMENTAL MANAGEMENT PLAN (EMP)

A. Institutional Framework

264. 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

265. 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.

266. MOF is the responsible government body for coordination on donor assistance with ADB and other donors.

267. 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.

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268. 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:

- environmental legislation, set rules, limits and standards of environmental management, standards for emissions and discharges of pollutants and waste disposal in the environment;
- requirements of industrial safety in the construction, expansion, reconstruction, modernization, operation, conservation and liquidation of hazardous production facilities;
- requirements of land legislation;
- requirements for safe operation of equipment and facilities for storage and distribution of petrochemicals and gas, cranes;
- requirements of safe use rules in the construction, assembling; and,
- commissioning of electrical networks and electrical equipment.

269. 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. The Department also establishes Maximum Permissible Concentrations of chemicals in the environment with regard to the human health safety.

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

271. Responsibilities for the implementation of the monitoring requirements of this report are summarized in Table 25 and Table 26 the Environmental Mitigation Monitoring Plan (EMP).

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

1. The tender and contract documents will clearly set out the contractor's obligations to undertake environmental mitigation measures set out in the Environmental Management Plan.
2. 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.
3. 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.
4. CSC will conduct environmental monitoring and assist IPIG in implementing EMP and supervising the implementation of mitigation measures by the contractors.

B. Reporting Requirements

273. MOTR will monitor and measure the progress of EMP implementation. 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 and then disclosed on the ADB and MOTR websites. To date two semi annual reports have been completed, covering the 2017 construction period 06-12-2017 and the period of 01-06 2018,

C. Environmental Management Plan

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

I. Mitigation Plan

275. The EMP consists of Table 25, which lists the environmental mitigation measures, and Table 26, which lists the environmental monitoring actions to check compliance and effectiveness of the mitigation measures.

Table 25 Environmental Management Plan: Environmental Mitigation Table (EMiT)

N°	Environment Issue	Mitigative Measures	Time Frame	Location	Implement By/ Supv. By	Implement/Suprv.
1	**PRECONSTRUCTION PERIOD**					
1.1	Environmental mitigation and monitoring measures not included in contract specifications	As part of the bid document preparation the contract engineer will work with the environmental specialist to ensure that adequate environmental clauses are inserted into the contract and that an environmental section of the Bill-of-Quantities be prepared	During the detailed design and while the bid documentation is being prepared – *completed according to mitigative measure-*	Project Office	CSC and IPIG/IPIG	CSC &IPIG/IPIG
1.2	Complete and translated environmental assessment document, including EMP, not distributed to all relevant stakeholders, including MOTR field managers.	CSC to prepare a distribution list for safeguard documents, make appropriate soft and hard copies and confirm that they have been distributed during the detailed design period	During the detailed design period *completed according to mitigative measure-*	Project Office	CSC and IPIG/IPIG	CSC &IPIG/IPIG
1.3	Loss of Top Soil	MOTR/IPIG will prepare an earthworks checklist that defines for the contractor, limits to the excavation during the road rehabilitation. Instructions for topsoil management will also be defined, including the removal and storage of all topsoil, for later use in landscaping, once the road work is completed. Use of soil from private land will be minimized and only after consultation and recorded agreement with landowners on compensation	During Planning phase, in parallel with the preparation of bid documents *SSEMP completed according to mitigative measure-*	At any locations where borrow pits, quarries will be operated.	CSC/MOTR	PMU/CSC

N°	Environment Issue	Mitigative Measures	Time Frame	Location	Implement By/ Supv. By	Implement/Suprv.
1.4	Uncontrolled establishment of materials (gravel, aggregate, sand) borrow areas	Using the borrow site location map provided in the EMP (Figure 6 of the IEE),the CSC will identify any areas where new sites are necessary and specify the process needed to seek permission from landowners, open and operate the site and then decommission/close and rehabilitate. These steps will be closely in line with the following KR standards:	During Planning phase, in parallel with the preparation of bid documents *Permits obtained*	Project Office	CSC/IPIG-MOTR	CSC/ IPIG & MOTR
1.5	Uncontrolled waste asphalt storage and disposal	At least 1 million m^3 of road asphalt will be removed, stored and mostly reused during the road rehabilitation work. This means large temporary storage areas and logistical problems and likely property degradation. To minimize that an asphalt handing protocol will be established. 1) temporary roadside storage and processing sites will be established 2) management of the waste asphalt will be defined, in terms of allowable waste height and prevention of obstructions and dust; 3) Processing, hauling and dust control associated with this work will be defined. To address this a SSEMP dealing with waste asphalt management (Annex 7) has been prepared for use by the contractor.	During the detailed design period and referenced in the bid documents as contractors requirement *SSEMP prepared*	Project Office, IPIG and ADB	IPIG/CSC/ MOTR	CSC/ IPIG & MOTR

N°	Environment Issue	Mitigative Measures	Time Frame	Location	Implement By/ Supv. By	Implement/Suprv.
1.6	Materials Haul Routes	Construction vehicles hauling materials along urban roads and anywhere where there are roadside residence will be limited and the CSC will establish a route plan to minimize this disruption	During contractor mobilization, i.e. before contractor starts work in the file *Not achieved*	On all identified haul routes, including an newly established aggregate sites	CSC/IPIG-MOTR	CSC/ IPIG & MOTR
1.7	Consultation Plan with affected roadside landowners	The work will result in restricted access from a businesses and residences to the road, and mitigative measures are required. CSC will prepared a three step process for implementation by the contractor. 1) consult and notify the roadside resident of the upcoming work and temporary blockages 2) define the actions to be taken to reduce the inconvenience and 3) describe the rehabilitation and restoration actions to restore good road access immediately after the work is done	Complete prior to contractor mobilization and provide to the contractor as part of the contract documentation. *according to mitigative measure-*	Applied to any location where there is likelihood of delays and temporary access restrictions	CSC/ IPIG-MOTR	CSC/ IPIG & MOTR
1.8	Inadequate Tree Cutting and Restoration Plan. **See SSEMP Annex 10**	Preliminary design calls for the cutting of 4,000 and 7,000 mature trees mostly English elms, Lombardy poplars and white poplars; to make way for the widened carriageway. This will have a major impact on local air temperatures, shading of roadway and roadside residence during summer and winter windbreaks. Cutting the trees will be a significant negative climate change effect. To minimize this the CSC will prepare a tree cutting plan,	Complete prior to contractor mobilization and provide to the contractor as part of the contract documentation	Completed for the entire road section	CSC with input from Forestry Dept./ IPIG-MOTR	CSC + Forestry Dept./IPIG+MOTR

N°	Environment Issue	Mitigative Measures	Time Frame	Location	Implement By/ Supv. By	Implement/Suprv.
		with a view to protecting as many trees as possible, to the extent that in some areas the shoulders and carriageway width will be reduced to protect trees. As part of the plan a comprehensive replanting schedule of 5-7 year old trees, to be provided by local nurseries, will be completed. Planting shall be conducted after technical works have been completed , in March till April)and/or September till October) The trees shall be planted with appropriate setbacks, at the spots where the tree losses have occurred Trees will be 1.5 – 2 m in height , 5 – 7 years of age; Distance between individual trees shall be 6 – 8 m; and the suggested planted species will be *Juglans regia (English walnut), Acer negundo (Box Elder), Ulmus carpinifolia (European elm), Populus alba (Lombardy poplar), Salix alba (white willow) and (Black locust)*				
1.9	Contractor's Occupational and Environmental health and Safety Capacity. **.**	The contract will include the requirement for an H&S Officer and require the contractor to define Occupational and Environmental Health and Safety standard for all work, including work camp operation, management of cement dust, and use of Personal Safety Equipment. The standard will be based on KR regulations and if they are not available, Int'l Labour	Standard to be prepared prior to field mobilization of the contractor. **See SSEMP Annexes 3 & 4.**	The standards will be applied to all work undertaken by the contractor or any subcontractor	IPIG/CSC	IPIG/CSC

N°	Environment Issue	Mitigative Measures	Time Frame	Location	Implement By/ Supv. By	Implement/Suprv.
		Organization (ILO) standards.				
1.10	Lack of environmental safeguard capacity with the CSC	The CSC will be required to have a resident specialist, who will be responsible for ensuring that the tasks defined in the EMP and any other environmental items in the contract specifications are implemented. To achieve that the specialist will be require to prepare a checklist of clauses and use these throughout the project to monitoring compliance. CSC specialist to be retained as part of the CSC contract.	The checklist is to be prepared prior to contractor mobilization but after the contractor has been selected *Hired specialist*	Project Office	CSC/ IPIG-MOTR	CSC/IPIG+MOTR
2	**CONSTRUCTION PERIOD**					
2.1	**Tasks 1.1 through 1.8 listed above not implemented**	At the start of the construction period the contractor and CSC will review the preconstruction EMP actions and confirm that they have been implemented and that all necessary deliverables are complete and in hand. CSC will be required to fill any gaps identified.	Within the 1st month of contractor mobilization *Not done correctly*	Project Office	CSC and Contractor/ IPIG-MOTR	

N°	Environment Issue	Mitigative Measures	Time Frame	Location	Implement By/ Supv. By	Implement/Suprv.
2.2	**Dust and Air Quality**					
2.2.1	Dust Generation: Transportation of Material: A small increase in particulate matter (dust) is expected at the location of rehabilitation works and from vehicles hauling materials to the rehabilitation areas.	I. The Contractor will be required to spray water on uncovered sand and gravel layers in dry periods within villages and near houses located close to the road and to cover the trucks used for transport. II. Dust control at the construction site will be controlled by watering during dry periods and setting strict speed limits of no more than 30kph across the rehabilitation sections.	Throughout the construction period **See SSEMP Annex 11**	Anywhere where there is material moved, earthworks cutting and filling.	Contractor/ CSC	
2.2.2	Dust Generation: Quarry and Batching Plant Operation and removal and placement of cut and fill materials respectively, including asphalt. **See SSEMP Annex 11**	I. The works will include large concrete works for and shall be carried out without a batching plant. Therefore no mitigation is required. II. Dust during manual batching for small concrete structure shall be minimized by slow and controlled mixing of the cement with aggregate to produce concrete. III. dust during material extraction and movement shall be controlled through transport in batched trucks and watering during dry period. V. iv. The > 1 million m3 of asphalt-concrete wearing course of the existing road will be totally replaced, requiring the excavation, storage, reprocessing and reuse of the granulated material as road	Throughout the construction period iv. Collect and analyze core samples prior to start of removal of asphaltic layer if asbestos fibers are detected, provide protective clothing and masks to all workers coming contact with removal and crushing work.	i-ii Anywhere where there is material moved, earthworks cutting and filling. iv.cores to be taken from all pavement sections and protective gear distributed immediately if asbestos is present.	Contractor/ CSC	

N°	Environment Issue	Mitigative Measures	Time Frame	Location	Implement By/ Supv. By	Implement/Suprv.
		sub-base or recycled for use on secondary roads. Pavement milling/scraping, crushing and reprocessing generates large quantities of dust, which when working with old asphalt-concrete may contain asbestos fibers. Therefore, dust suppression equipment, and protective gear for workers, will be required and at least 10 core samples taken and tested for asbestos fiber content, before any work begins.	**See SSEMP Annex 11**			
2.2	Increase in air pollution from vehicular and machinery exhaust . **See SSEMP Annex 9**	Emissions will be minimized by: i. ensuring that the contractor's fleet of vehicles are properly maintained according to manufacturer's specifications; ii. use of appropriate octane fuel and haul loads within specified limits. iii. Vehicle idling time when not in use, limited to no more than 3 minutes, iv. Equipment such as the diesel generator will be included in the emission control program and will be and regularly tuned to prevent excessive temporary pollution.	During the Construction period **See SSEMP Annex 9**	Construction Site	Contractor/ CSC	
2.3	Solid waste management at the construction site,. **See SSEMP Annex 5**	No open incineration of solid waste (garbage) and construction materials shall be permitted on site. All plastics , paper and useable	During the Construction period **See SSEMP Annex 5**	Construction Site	Contractor/ CSC	

N°	Environment Issue	Mitigative Measures	Time Frame	Location	Implement By/ Supv. By	Implement/Suprv.
		wood will be recycled. Wood scraps can be burned.				
2.4	**Surface and Groundwater**					
2.4.1	**Contamination of Water Resources (Surface & Groundwater)** Surface water can be polluted by leaking fuel storage, liquid bitumen and other chemicals used in rehabilitation works. Groundwater contamination from surface runoff leaking into roadside wells. **See SSEMP Annex 5**	i. Fuel and oil storage areas should be at least 500m away from watercourses and repair yards to be equipped with an impervious platform, with interceptor traps so that any fuel leakage is retained within the site. ii. All fuel storage sites must be checked daily for leaks and held in an impervious site where spilled/leaking material can be collected. iii. Wash down water from machinery repair areas to be directed into this system that retains the oil and grease. Refueling not to be permitted within or adjacent to watercourses. Surface water channels crossed by the road will be monitored upstream and downstream of the road before, during and after the work has been completed on that crossing.	Throughout the construction period **See SSEMP Annex 5**	All construction sites	Contractor	
2.4.2	Interruption / Contamination of Water channels: Movement/drainage of surface water interrupted due to	i. Contractor should provide the adequate sized diversion, so that there shall be no disturbance to water flows of canal /water course. The placement of temporary	Construction period **See SSEMP Annex 8.**	Culverts and bridges	Contractor EHS Officer	

N°	Environment Issue	Mitigative Measures	Time Frame	Location	Implement By/ Supv. By	Implement/Suprv.
	improper culvert construction activities, inadequate diversions and notifications. **See SSEMP Annex 8.**	culverts must avoid scouring and erosion and water leaves the temporary diversion ii. Protection mechanism should be provided to avoid contamination. iii. The land used for the temporary diversion and the water course shall be restored as far as possible to its initial state once the work has been completed				
2.4.3	Use of scarce potable groundwater for concrete production	iv. Extraction of groundwater for use with concrete production will be controlled by permit and local authority approval. Contractors will be required to have these permits in hand before initiating extraction for concrete mixing.	Determined not to be an issue			
2.5	**Flora and Fauna**					
2.5.1	Loss of roadside vegetation and trees	The project requires the cutting of between 4,000 and 7,000 mature trees, for which a plan will be prepared as defined in Task 1.8. This must be fully adhered to and implemented completely by the contractor. Only trees marked for cutting will be removed. All cutting required shall be monitored according to the KR Law "General technical rules and regulations for environmental safety in the Kyrgyz Republic", #151, Clause 12 dtd. 08.05.2009. and the Law of KR "On Protection and Use of Flora",	Throughout the consrtruction period when tree cutting is planned ***SEE SSEMP-ANNEX 10*** *Also, replanting plans prepared and being implemented*	At any locations where mature trees will be cut down.	Contractor	

N°	Environment Issue	Mitigative Measures	Time Frame	Location	Implement By/ Supv. By	Implement/Suprv.
		#53 dtd. 20.06.2001. When work is finished in anyone area, tree replanting should start, i.e. not waiting until the entire road is completed.				
2.6	**Spoil and Solid Waste**					
2.6.1	Inappropriate use of asphalt layers and base materials removed from the existing road **See SSEMP Annex 7**	Old asphalt taken from the highway may be re-used in the soft shoulders or as fill for other parts of the rehabilitation works. It may also be used as back-fill for borrow pits and then over-lain with top soil. Asphalt pieces can be spread on adjacent roads as surface or pothole fill material and compacted, as agreed to by local authorities and contractor. Both parties will be required to adhere to the specifications defined in SSEMP-Annex 7 of the IEE, addressing the management of waste asphalt placement in rural roads.	During Construction **See SSEMP Annex 7**	All Construction Sites	Contractor working closely with local authorities on every road	CSC
2.6.2	Unused construction material (sand, crush), empty drums, concrete waste and waste from work camps. **See SSEMP Annex 5**	i. The contractor will identify dumping locations for construction debris and non-hazardous solid waste with DEP9/Bishkek-Osh and the CSC ii. The contractor shall identify any hazardous waste as part of its health and safety plan and dispose of the material through an approved waste management contractor;	During Construction **See SSEMP Annex 5**	All Construction Sites	Contractor	CSC

N°	Environment Issue	Mitigative Measures	Time Frame	Location	Implement By/ Supv. By	Implement/Suprv.
		especially bitumen. iii. The cost of disposal of hazardous (lubricant drums, waste oil, hydraulic fluid, engine filters) and non-hazardous waste shall be included in the Contractors BOQ.				
2.7	**Quarry/Borrow Materials**					
2.7.1	Preservation of Top Soil **SEE SSEMP ANNEX 14**	Topsoil will be saved and stored at designated sites, but cannot be used in vegetable gardens due to high lead levels in the soil	During Construction **SEE SSEMP ANNEX 14**	At any locations where borrow pits, quarries will be operated.	Contract	
2.7.2	Overloading of trucks, may damage pavement, bridges, and culverts	The Contractor will ensure that loaded trucks do not exceed road, bridge and pavement specifications and are checked by weighbridges. The contractor will be required to monitor the transport of material, recording vehicle movements and weights, to be inspected. An agreement must be reached in writing with local authorites stating that the contractor will repair roads to pre-construction conditions once work is done	Near end of construction season *Agreements with local authorities to repair after work completed, obtained*	Construction sites and all haul roads	Contractor EHS Inspec-tor	CSC
2.7.3	Opening of new borrow pits without permit or management plan	If new borrow pit is required contractor will: **1.** Prepare a sketch map of site to be used, access road and volume to be extracted, then seek approval from CSC. **2**. Get approval for the site, based in KR regulation and agreement with landowner; **3.** Open the site by first stockpiling topsoil and securing the	Prior to the opening of any new borrow site **SEE SSEMP ANNEX 14**	At any site where material is take for the road construction, either outside or inside the impact corridor	Contrac-tor	

N°	Environment Issue	Mitigative Measures	Time Frame	Location	Implement By/ Supv. By	Implement/Suprv.
		area against erosion. **4.** Decommission the site after work is complete, including landscaping and revegetation: 5.Prepare a table showing the 5 actions and notation of what action was taken, sign it and submit to CSC.				
2.7.4	Risk of erosion and destruction of landscape from side borrow operations.	Side- borrowing along or outside the RoW will not be permitted unless a construction emergency arises, and which will trigger a mandatory consultation with the Environmental Officer of IPIG.				
2.8	**Noise and Vibration**					
2.8.1	Noise associated with earthworks and haul roads. **See SSEMP Annex 6**	i. Enforcing a speed limit of 30 kph within 500m of any village. ii. Restricting operating hours through roadside villages and settlements to between hours of 0700 and 1800. iii. Large and noisy machinery operations close to urban areas are restricted to daylight hours, and a schedule agreed to between contractor and local communities.	During Construction period **See SSEMP Annex 6**	Construction areas	Contractor EHS Inspector	
2.8.2	Noise with compaction of asphalt and unbound materials	All compaction to be done without vibration	Entire construction site at all times			
2.9	**Health and Safety**					
2.9.1	Damage / disturbance to Utilities within RoW	There is no relocation of utilities required under the contract, therefore there is no monitoring of eventual disruptions.	----	---	-----	

N°	Environment Issue	Mitigative Measures	Time Frame	Location	Implement By/ Supv. By	Implement/Suprv.
2.9.2	Traffic Disturbance : Loss of access for roadside residents **SEE SSEMP ANNEX 3 AND 4**	Contractor shall provide safe and convenient passage for vehicles and pedestrians to and from side roads and properties connecting the project road/area. In case such work occurs, traffic management arrangement shall be submitted for approval by the Supervision Engineer , after consultation with local people and the police, before the work takes place, and according to local regulations.	Construction Period **SEE SSEMP ANNEX 3 & 4**	Town Crossings	Contractor EHS Inspector	
2.9.3	Health and Safety Concerns: Protecting the workforce and maintaining a safe working environment. **SEE SSEMP ANNEX 3**	i. Contractor must provide safety vests, hard hats and protective footwear for all workers handling heavy machinery, and working with hazardous materials such as concrete, asphalt, paints, and cleaning agents . ii. Contractor must provide protective masks to machine operators, where dust can be generated, and to anyone working in the area of the machines, with masks of a micron size, capable of capturing dust down to 2 microns. iii. Any works at night should be adequately lit and high visibility clothing worn and contractor should provide basic training on use of protective clothing and equipment.	Construction period **SEE SSEMP ANNEX 3**	Contractor's Depots and work areas	Contractor EHS Officer	
2.9.4	Contractor's work areas and depots	i. All depots shall be provided with septic sanitation facilities	Throughout the construction	Contractor's Depots and	Contractor EHS	

N°	Environment Issue	Mitigative Measures	Time Frame	Location	Implement By/ Supv. By	Implement/Suprv.
	not maintained, no proper waste management, environmental health and safety measures.	and potable water. ii. Monitoring will be required for the solid waste disposal at the depot and to ensure that the health and safety plan based on contract specifications is followed. iii. During operation, the surface of the depot used for storage of construction materials shall be protected against run-off and spills of hazardous materials using impermeable protection covering the ground and a system to collect contaminated run-off.	period. **SSEMP Annex 4 applied**	work areas	Inspector	
2.10	Lack of contractor's construction period mitigation completion report	Contractor will be required to prepare and safeguards implementation at the end of the construction period, discussing very briefly, each construction period EMP item.	Prior to final payment to contractor	NA	Contractor	CSC
2.11	Lack of transport and facility for CSC environmental auditor to conduct compliance monitoring.	A mandatory semi-annual environmental monitoring report must be filed by the client for ADB. Data for that will be assembled based on weekly and monthly environmental inspections by the CSC's environmental specialist. Once a year the Int'l Env. Specialist will conduct a due diligence compliance audit. To complete this work the CSC Env. Specialist will be provided with transportation as needed, as	Conduct inspection of all operations every three months, including contractor yard, file semi annual monitoring report and Annual DD audit.	Across the entire construction area , including all subcontractor facilities	CSC and Contractor	CSC

N°	Environment Issue	Mitigative Measures	Time Frame	Location	Implement By/ Supv. By	Implement/Suprv.
		well as working space in the field				
2.12	Failure to protect 13 sensitive site identified in the IEE	The 13 sites especially sensitive to air and noise quality degradation have been identified in the IEE. A construction period air, noise and surface water quality testing program will be undertaken quarterly according to the design defined in the IEE SSEMP Annexes 6,7 and 8	Throughout the construction period	AT 13 sensitive sites using the sampling design provided in the IEE	CSC and Contractor	CSC
3	**OPERATING PERIOD**					
3.1	Failure to confirm submission of report defined in 2.10 above	The contractor will provide an mitigation and monitoring completion report listing all actions taken in compliance with this EMP items defined and with any other safeguard requirement specified in the contract and submit that to IPIG before the final payment can be released. IPIG will review and approve this report.	1 month before the end of the contract period	NA	Contractand CSC	CSC
3.2	Environmental Quality improved	Maintenance contractor or DEP9 will endeavor to keep road dust free and speed limit signs will be maintained. Traffic Police will improve enforcement of limits and conduct spot checks.	Operating Period	All villages & towns	MOTR and Traffic Police for traffic regs	CSC
3.3	Inadequate maintenance of large roadside tree plantation See SSEMP Annex 10	Based on MOTR's DEP9 guidance, ensure that trees planted remain healthy, protected from grazing animals , receive water. Annual tree count will be required and any dead trees will need to replaced.	At the start of the operating period and every two months for the 1st year and semi annually for the next 2 years.	All areas where tree planting took place during the construction period	MOTR's highway maintenance unit	CSC

N°	Environment Issue	Mitigative Measures	Time Frame	Location	Implement By/ Supv. By	Implement/Suprv.
3.4	Risk of Accident and Injury reduced **See SSEMP Annex 1**	Appropriate traffic calming and signage will be installed for the driver, speed limits shall be monitored by the traffic police to avoid any accident and subsequent spillage. An emergency service may be provided by the local authorities.	Post-Implementation period	As per design	Contractor and Traffic police	CSC

II. The Environmental Monitoring Plan

276. Environmental monitoring (Table 26) 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 26 Environmental Management Plan-Environmental Monitoring Table (EMoT);See EMiT for applicable SSEMPs

N°	Environmental Issue	Mitigation measures	Monitoring Action	Timing	Monitoring Deliverable	Implemented by	Supervised by
1	**PRECONSTRUCTION PERIOD**						
1.1	Environmental mitigation and monitoring measures not included in contract specifications	As part of the bid document preparation the contract engineer will work with the environmental specialist to ensure that adequate environmental clauses are inserted into the contract and that an environmental section of the Bill-of-Quantities be prepared	Confirm that clauses are in contract documents	During the detailed design and while the bid documentation is being prepared	Compliance monitoring checklist item marked	CSC and IPIG	IPIG
1.2	Complete and translated environmental assessment document, including EMP, not distributed to all relevant stakeholders, including MOTR field managers	CSC to prepare a distribution list for safeguard documents, make appropriate soft and hard copies and confirm that they have been distributed during the detailed design period	Confirm distribution list and appropriate materials	During the detailed design period	Compliance monitoring checklist item marked	CSC and IPIG	IPIG
1.3	Loss of Top Soil	MOTR/IPIG will prepare an earthworks checklist that defines for the contractor, limits to the excavation during the road rehabilitation. Instructions for topsoil for later use management will also be defined, including the removal and storage of all topsoil to be used in landscaping, once the road work is completed. Use of soil from private land will be minimized and only after consultation and recorded agreement with landowners on compensation	Monitor checks that topsoil management steps prepared and ready for implementation	During Planning phase, in parallel with the preparation of bid documents	Copy of topsoil protection actions and mark checklist as above	PMU	Supervision Consultant

N°	Environmental Issue	Mitigation measures	Monitoring Action	Timing	Monitoring Deliverable	Implemented by	Supervised by
1.4	Uncontrolled establishment of materials (gravel, aggregate, sand) borrow areas	Using the borrow site location map provided in the EMP (Figure 7),the CSC will identify any areas where new sites are necessary and specify the process needed to seek permission from landowners, open and operate the site and then decommission/close and rehabilitate. These steps will be closely in line with the following KR standards:	Confirm that steps for establishing new sites have been prepared by CSC and are ready for distribution to contractor	During Planning phase, in parallel with the preparation of bid documents	Compliance monitoring checklist item marked	CSC	IPIG/MOTR
1.5	Uncontrolled waste asphalt storage and disposal	At least 1 million m^3 of road asphalt will be removed, stored and mostly reused during the road rehabilitation work. This means large temporary storage areas and logistical problems and likely property degradation. To minimize that an asphalt handing protocol will be established. 1) temporary roadside storage and processing sites will be established 2) management of the waste asphalt will be defined, in terms of allowable waste height and prevention of obstructions and dust; 3) Processing, hauling and dust control associated with this work will be defined	Review protocol and confirm it is according to mitigation item and is ready for contractor's use	During the detailed design period and referenced in the bid documents as contractors requirement	Compliance monitoring checklist item marked	CSC	IPIG/ MOTR
1.6	**Materials Haul Routes**	Construction vehicles hauling materials along urban roads and anywhere where there are roadside residence will be limited and the CSC will establish a route plan to minimize this disruption.	Route plan confirmed by PMU-planners and recorded for use in audit report	Prior to contractor mobilization	Written and dated note indicating compliance & inspection	CSC	IPIG/ MOTR
1.7	Consultation Plan with affected roadside landowners	The work will result in restricted access from a businesses and residences to the road, and mitigative measures are required. CSC will prepared a three step process for implementation by the contractor. 1) consult and notify the roadside resident of the upcoming work and temporary blockages 2) define the actions to be taken to reduce the inconvenience and 3) describe the rehabilitation and restoration actions to restore good road access immediately after the work is done	Confirm that process has been passed on to contractor and will be implemented	Complete prior to contractor mobilization and provide to the contractor as part of the contract documentation	Compliance monitoring checklist item marked	CSC	IPIG/ MOTR

N°	Environmental Issue	Mitigation measures	Monitoring Action	Timing	Monitoring Deliverable	Implemented by	Supervised by
1.8	Inadequate Tree Cutting and Restoration Plan	Preliminary design calls for the cutting of 4,000 and 7,000 mature trees mostly English elms, Lombardy poplars and white poplars; to make way for the widened carriageway. This will have a major impact on local air temperatures, shading of roadway and roadside residence during summer and winter windbreaks. Cutting the trees will be a significant negative climate change effect. To minimize this the CSC will prepare a tree cutting plan, with a view to protecting as many trees as possible, to the extent that in some areas the shoulders and carriageway width will be reduced to protect trees. As part of the plan a comprehensive replanting schedule of 5-7 year old trees, to be provided by local nurseries, will be completed. Planting shall be conducted after technical works have been completed , in March till April)and/or September till October) The trees shall be planted with appropriate setbacks, at the spots where the tree losses have occurred Trees will be 1.5 – 2 m heigh, 5 – 7 years of age; Distance in between individual trees shall be 6 – 8 m; and the suggested planted species will be *Juglans regia (English walnut), Acer negundo (Box Elder), Ulmus carpinifolia (European elm), Populus alba (Lombardy poplar), Salix alba (white willow) and (Black locust)*	Inspect tree management program and confirm it is in compliance with mitigative action as defined in the EMP	Complete prior to contractor mobilization and provide to the contractor as part of the contract documentation	Copy of tree management program on file	CSC with input from Forestry Dept.	IPIG/MOTR
1.9	Contractor's Occupational and Environmental health and Safety Capacity	The contract will include the requirement for an H&S Officer and require the contractor to define Occupational and Environmental Health and Safety standard for all work, including work camp operation, management of cement dust, and use of Personal Safety Equipment. The standard will be based on KR regulations and if they are not available, Int'l Labour Organization (ILO) standards	Review Construction contracts and specifications- to check content for OHS plan content.	Plan to be provided to the Supervision Engineer and IPIG prior to start of work	Written and dated note indicating compliance	IPIG	CSC

N°	Environmental Issue	Mitigation measures	Monitoring Action	Timing	Monitoring Deliverable	Implemented by	Supervised by
1.10	Lack of environmental safeguard capacity with the CSC	The CSC will be required to have a resident specialist, who will be responsible for ensuring that the tasks defined in the EMP and any other environmental items in the contract specifications are implemented. To achieve that the specialist will be require to prepare a checklist of clauses and use these throughout the project to monitoring compliance.	Confirm presence of environmental specialist with CSC	CSC specialist to be retained as part of the CSC contract. The checklist is to be prepared prior to contractor mobilization but after the contractor has been selected	Copy of name and contract duration on file	CSC	IPIG/ MOTR
2	**CONSTRUCTION PERIOD**						
2.1	Tasks 1.1 through 1.8 not implemented	At the start of the construction period the contractor and CSC will review the preconstruction EMP actions and confirm that they have been implemented and that all necessary deliverables are complete and in hand. CSC will be required to fill any gaps identified.	Review compliance during preconstruction period	Within 1st month of contract award	Compliance checklist filled in	CSC and Contractor	CSC/IPIG
2.2 Dust and Air Quality							
2.2.1	Dust Generation: Transportation of Material: A small increase in particulate matter (dust) is expected at the location of rehabilitation works and from vehicles hauling materials to the rehabilitation areas.	i. The Contractor will be required to spray water on uncovered sand and gravel layers in dry periods within villages and near houses located close to the road and to cover the trucks used for transport. ii. Dust control at the construction site will be controlled by watering during dry periods and setting strict speed limits of no more than 30kph across the rehabilitation sections.	Travel work areas and check for dust—and if found take immediate action with contractor	Anywhere where there is material moved, earthworks cutting and filling.	Written and dated note indicating compliance or issue and action taken	IPIG	CSC
2.2.2	Dust Generation: Quarry and Batching Plant Operation and removal and placement of cut and fill materials	i. The works will include large concrete works for and shall be carried out without a batching plant. Therefore no mitigation is required. ii. Dust during manual batching for small concrete structure shall be minimized by slow and controlled mixing of the cement	Travel Quarry and Works site and check for dust—and if found take immediate action with contractor.	Throughout the construction period	Written and dated note indicating compliance or issue and action taken	Contractor	CSC

N°	Environmental Issue	Mitigation measures	Monitoring Action	Timing	Monitoring Deliverable	Implemented by	Supervised by
	respectively, including asphalt	with aggregate to produce concrete. iii. dust during material extraction and movement shall be controlled through transport in batched trucks and watering during dry period. iv. The > 1 million m^3 of asphalt-concrete wearing course of the existing road will be totally replaced, requiring the excavation, storage, reprocessing and reuse of the granulated material as road sub-base or recycled for use on secondary roads. Pavement milling/scraping, crushing and reprocessing generates large quantities of dust, which when working with old asphalt-concrete may contain asbestos fibers. Therefore, dust suppression equipment, and protective gear for workers, will be required and at least 10 core samples taken and tested for asbestos fiber content, before any work begins.		iv. Collect and analyze core samples prior to start of removal of asphaltic layer if asbestos fibers are detected, provide protective clothing and masks to all workers coming contact with removal and crushing work.			
2.2.3	Increase in air pollution from vehicular and machinery exhaust	Emissions will be minimized by: v. ensuring that the contractor's fleet of vehicles are properly maintained according to manufacturer's specifications; vi. use of appropriate octane fuel and haul loads within specified limits. vii. Vehicle idling time when not in use, limited to no more than 3 minutes, viii. Equipment such as the diesel generator will be included in the emission control program and will be and regularly tuned to prevent excessive temporary pollution.	Record findings and conduct regular inspections in association with construction supervision	During the Construction period	Inspection Note to file for use in contractor's reporting and in audit reports.	Contractor	CSC
2.3	Solid waste management at the construction site	No open incineration of solid waste (garbage) and construction materials shall be permitted on site. All plastics , paper and useable wood will be recycled. Wood scraps can be burned.	Record findings and conduct regular inspections in association with construction supervision	During the Construction period	Inspection Note to file for use in contractor's reporting and in audit reports.	Contractor	CSC
2.4 Surface and Groundwater Quality							

N°	Environmental Issue	Mitigation measures	Monitoring Action	Timing	Monitoring Deliverable	Implemented by	Supervised by
2.4.1	Contamination of Water Resources (Surface & Groundwater) Surface water can be polluted by leaking fuel storage, liquid bitumen and other chemicals used in rehabilitation works. Groundwater contamination from surface runoff leaking into roadside wells.	i. Fuel and oil storage areas should be at least 500m away from watercourses and repair yards to be equipped with an impervious platform, with interceptor traps so that any fuel leakage is retained within the site. ii. All fuel storage sites must be checked daily for leaks and held in an impervious site where spilled/leaking material can be collected. iii. Wash down water from machinery repair areas to be directed into this system that retains the oil and grease. Refueling will not be permitted within or adjacent to watercourses. Surface water channels crossed by the road will be monitored upstream and downstream of the road before, during and after the work has been completed on that crossing. iv. Water channels have to be diverted properly, protection arrangements should be provided at each culvert / water crossing. v. v. Small concrete works at bridges and culverts shall be done by mixing in small mixing machine or by hand, by protecting the area of mixing with impermeable cloth, and all remaining unused concrete shall be evacuated to an agreed dump or used on local roads if need is expressed by local residents	Regular inspection of work camps, contractors yard, fueling areas , fuel storage	At least monthly throughout the construction period.	Checklist showing the check of fuel and lubricant handling, waste oil management, machinery was down water control, etc. signed and dated--filed. Checklist showing the check for lighting and signage signed and date filled .	IPIG	Supervision Consultant
2.4.2	Interruption / Contamination of Water channels: Movement/drainage of surface water interrupted due to improper culvert construction activities,	i. Contractor should provide the adequate sized diversion, so that there shall be no disturbance to water flows of canal /water course. The placement of temporary culverts must avoid scouring and erosion and water leaves the temporary diversion ii. Protection mechanism should be provided to avoid contamination.	Inspection of diversion along the road, check signage, lighting any leakage etc at the diversions and rectify through contractor. Ensure contractor has adequately	Construction period	Contractor EHS Officer	Contractor	CSC

N°	Environmental Issue	Mitigation measures	Monitoring Action	Timing	Monitoring Deliverable	Implemented by	Supervised by
	inadequate diversions and notifications.	iii. The land used for the temporary diversion and the water course shall be restored as far as possible to its initial state once the work has been completed	restored temporary work areas.				
2.4.3	Use of scarce potable groundwater for concrete production	Extraction of groundwater for use with concrete production will be controlled by permit and local authority approval. Contractors will be required to have these permits in hand before initiating extraction for concrete mixing.	Confirm paperwork and permits in place for groundwater extraction.	Prior to the need to extract groundwater for concrete production	Note indicating compliance to record for semi-annual report to ADB		
2.5 Fauna & Flora							
2.5.1	Loss of Vegetation and trees	The project requires the cutting of between 4,000 and 7,000 mature trees, for which a plan will be prepared as defined in Task 1.8. This must be fully adhered to and implemented completely by the contractor. Only trees marked for cutting will be removed. All cutting required shall be monitored according to the KR Law "General technical rules and regulations for environmental safety in the Kyrgyz Republic", #151, Clause 12 dtd. 08.05.2009. and the Law of KR "On Protection and Use of Flora", #53 dtd. 20.06.2001. When work is finished in anyone area, tree replanting should start, i.e. not waiting until the entire road is completed.	-Inspect tree planting and maintenance operation and confirm compliance with mitigation item 1.8 and 2.5.1 . Also provide ongoing list of tree planting activity	Throughout the consrtruction period when tree cutting is planned	Compliance report,bullet form that mitigatioin measures are being implemented	Contractor	CSC
2.6 Spoil and Solid Waste							
2.6.1	Inappropriate use of asphalt layers and base materials removed from the existing road	Old asphalt taken from the highway may be re-used in the soft shoulders or as fill for other parts of the rehabilitation works. It may also be used as back-fill for borrow pits and then over-lain with top soil. Asphalt pieces can be spread on adjacent roads as surface or pothole fill material and compacted, as agreed to by local authorities and contractor. Both parties will be required to adhere to the specifiecations defined in	Monitor to check waste handling and disposal procedure of contractor	Throughout construction period	Note to file, signed and dated	IPIG	Supervision Consultant

N°	Environmental Issue	Mitigation measures	Monitoring Action	Timing	Monitoring Deliverable	Implemented by	Supervised by
		SSEMP-Annex 7 of the IEE, addressing the management of waste asphalt placement in rural roads.					
2.6.2	Unused construction material (sand, crush), empty drums, concrete waste and waste from work camps.	i. The contractor will identify dumping locations for construction debris and non-hazardous solid waste with DEP9/Bishkek-Osh and the CSC ii. The contractor shall identify any hazardous waste as part of its health and safety plan and dispose of the material through an approved waste management contractor. i. The cost of disposal of hazardous (lubricant drums, waste oil, hydraulic fluid, engine filters) and non-hazardous waste shall be included in the Contractors BOQ.	Monitor to check waste handling and disposal procedure of contractor	Throughout construction period	Note to file, signed and dated	IPIG	Supervision Consultant
2.7 Quarry/Borrow Materials							
2.7.1	Preservation of Top Soil	Topsoil will be saved and stored at designated sites, but cannot be used in vegetable gardens due to high lead levels in the soil	i. Confirm that topsoil has been set aside ii. Check the use ir restricted to landscaping and not gardens.	During Construction period	Written and dated note indicating compliance or issue and action taken.	Contractor / IPIG	Supervision Consultant
2.7.2	Overloading of trucks, may damage pavement, bridges, and culverts	The Contractor will ensure that loaded trucks do not exceed road, bridge and pavement specifications and are checked by weighbridges. The contractor will be required to monitor the transport of material, recording vehicle movements and weights, to be inspected. An agreement must be reached in writing with local authorites stating that the contractor will repair roads	Examine weighbridge records and compare to amount of material moved	Throughout construction period	Obtain agreement between local authority and contractor and monitor work during defect period.	CSC	IPIG

N°	Environmental Issue	Mitigation measures	Monitoring Action	Timing	Monitoring Deliverable	Implemented by	Supervised by
		to pre-construction conditions once work is done					
2.7.3	Opening of new borrow pits without permit or management plan	If new borrow pit is required contractor will: **1.** Prepare a sketch map of site to be used, access road and volume to be extracted, then seek approval from CSC. **2**. Get approval for the site, based in KR regulation and agreement with landowner; **3.** Open the site by first stockpiling topsoil and securing the area against erosion. **4.** Decommission the site after work is complete, including landscaping and revegetation: 5.Prepare a table showing the 5 actions and notation of what action was taken, sign it and submit to CSC.	Confirm documentation prepared as defined in mitigative action No. 2.7.3	Prior to the opening of any new borrow site	Copy of documentation or permit no.	CSC and Contractor	IPIG
2.7.4	Risk of erosion and destruction of landscape from side borrow operations.	Side- borrowing along or outside the RoW will not be permitted unless a construction emergency arises, and which will trigger a mandatory consultation with the Environmental Officer of IPIG.	Inspect all side borrow activities and establish what permission given, and if none require immediate closure and restoration of the site.	Throughout construction period	Permit and relevant documentation on file	CSC and Contractor	IPIG
2.8 Noise and Vibration							
2.8.1	Noise and Vibrations associated with earthworks and haul roads.	iv. Enforcing a speed limit of 30 kph within 500m of any village. v. Restricting operating hours through roadside villages and settlements to between hours of 0700 and 1800. vi. Large and noisy machinery operations close to urban areas are restricted to daylight hours, and a schedule agreed to between contractor and local communities.	Using a portable noise meter, monitor works conditions , and inspect if work conducted within permitted time period in urban zones	During Construction period	Inspection Note to file for use in contractor's reporting with eventual noise measurements.	IPIG	Supervising Consultant

N°	Environmental Issue	Mitigation measures	Monitoring Action	Timing	Monitoring Deliverable	Implemented by	Supervised by
2.8.2	Noise associated with Compaction of asphalt and unbound materials	i. Application shall be carried out with equipment checked for compliance with the Laws of KR regarding noise and vibration on construction sites, as well as the standards defined in this EMP: SN 2.2.4/2.1.8.562-96 "Noise in working areas, dwelling accommodations, public buildings and on the territory of residential construction". i. Restricting operating hours in villages and settlements to between hours of 0700 and 1800.	Using a portable noise meter, monitor works conditions , and inspect if work conducted within permitted time period in urban zones	During Construction period	Table of noise measurements at sensitiver sites	Contractor	CSC
2.9 Health and Safety							
2.9.1	Traffic Disturbance : Loss of access for roadside residents	Contractor shall provide safe and convenient passage for vehicles and pedestrians to and from side roads and properties connecting the project road/area. In case such work occurs, traffic management arrangement shall be submitted for approval by the Supervision Engineer , after consultation with local people and the police, before the work takes place, and according to local traffic regulations.	i. Inspect construction areas where access is an issue and establish if contractor is managing problem and if local residents are satisfied. ii. Always identify by clear signage according to regulation maintenance activities on the roadway	Throughout construction period	Inspection note with findings, dated and signed	IPIG	Supervising Consultant
2.9.2	Health and Safety Concerns: Protecting the workforce and maintaining a safe working environment.	i. Contractor must provide safety vests, hard hats and protective footwear for all workers handling heavy machinery, and working with hazardous materials such as concrete, asphalt, paints, and cleaning agents. ii. Contractor must provide protective masks to machine operators, where dust can be generated, and to anyone working in the area of the machines, with masks of a micron size, capable of capturing dust down to 2 microns. iii. Any works at night should be	Inspection of construction sites to ensure proper use of OHS gear and contractor enforcement	Throughout construction period	Inspection note with findings, dated and signed	IPIG	Supervising Consultant

N°	Environmental Issue	Mitigation measures	Monitoring Action	Timing	Monitoring Deliverable	Implemented by	Supervised by
		adequately lit and high visibility clothing worn and contractor should provide basic training on use of protective clothing and equipment.					
2.9.3	Contractor's work areas and depots not maintained, no proper waste management, environmental health and safety measures.	i. All depots shall be provided with septic sanitation facilities and potable water. ii. Monitoring will be required for the solid waste disposal at the depot and to ensure that the health and safety plan based on contract specifications is followed. iii. During operation, the surface of the depot used for storage of construction materials shall be protected against run-off and spills of hazardous materials using impermeable protection covering the ground and a system to collect contaminated run-off.	Inspect all operations in the depots including worker housing and all waste management procedures.	Throughout the construction period	Inspection note re findings, dated and signed.	IPIG	Supervising Consultant
2.10	Lack of contractor's construction period mitigation completion report	Contractor will be required to prepare and safeguards implementation at the end of the construction period, discussing very briefly, each construction period EMP item.	Inspect and collect report	Prior to final payment to contractor	Copy of report on file	CSC and Contractor	IPIG
2.11	Lack of transport and facility for CSC environmental auditor to conduct compliance monitoring.	A mandatory semi-annual environmental monitoring report must be filed by the client with ADB. Data for that will be assembled based on quarterly environmental inspections by the CSC's environmental specialist. Once a year the Int'l Env. Specialist will conduct a due diligence compliance audit. To complete this work the CSC Env. Specialist will be provided with transportation as needed, as well as working space in the field	Conduct inspection of all operations every three months, including contractor yard, file semi annual monitoring report and Annual DD audit.	Every three months	Copy of report	CSC and Contractor	CSC/IPIG
2.12	Failure to protect sensitive site identified in the IEE	The sites have been identified in Annex 2_ of fhe IEE and parameter likely impacted identified, plus baseline measurements obtained both in 2013 and again in 2015. A	Examine field survey data on noise, air and surface wq at sensitive sites	Throughout the construction period	Data tables on file	Contractor	CSC

N°	Environmental Issue	Mitigation measures	Monitoring Action	Timing	Monitoring Deliverable	Implemented by	Supervised by
		construction period air, noise and surface water quality testing program will be undertaken quarterly according to the design defined in the IEE Annex 2 and by GPS coordinates.					
3	**OPERATING PERIOD**						
3.1	Failure to confirm submission of report defined in 2.10 above	The contractor provides a mitigation and monitoring completion report listing all actions taken in compliance with this EMP items defined and with any other safeguard requirement specified in the contract and submit that to IPIG before the final payment can be released. IPIG will review and approve	Obtain completion report and review for compliance.	1 month before the end of the contract period	Note to file and copy of the completion report	CSC	IPIG
3.2	Environmental Quality improved	The future maintenance contractor or DEP9 will endeavor to keep road dust free and speed limit signs will be maintained. Traffic Police will improve enforcement of limits and conduct spot checks.	MOTR to take necessary action.	Post-Implementation period	Note-to file to indicate status of the maintenance works	MOTR, contractor, and Traffic police	MOTR
3.3	Inadequate maintenance of large roadside tree plantation	Based on MOTR's DEP9 guidance, ensure that trees planted remain healthy, protected from grazing animals , receive water. Annual tree count will be required and any dead trees will need to replaced.	Inspect plantations and indicate dead tree numbers	At the start of the operating period and every two months for the 1st year and semi annually for the next 2 years.	Record of planning success in terms of trees dead and to be replanted	MOTR's highway maintenance unit	MOTR
3.4	Risk of Accident and Injury reduced	Appropriate traffic calming and signage will be installed for the driver, speed limits shall be monitored by the traffic police to avoid any accident and subsequent spillage. An emergency service may be provided by the local authorities.	MOTR to take necessary action.	Throughout the operating period	Note to file to indicate status of the maintenance works	MOTR, maintenance contractor, and Traffic police	MTC
3.5	Noise monitoring	Noise attenuation needed during operating period	MOTR	Operating phase-defect period	Noise measurements using a sound level meter.	MOTR and contractor	MOTR

III. The Construction Environmental Management Workplan (CEMWP)

277. Prior to start of the construction works, the contractor shall provide a workplan that lists the construction period EMP actions and adds detail and understanding to construction period mitigation and monitoring tasks. This is referred to as a CEMWP. It is essential for the contractor to complete this task since it is an excellent way to bring understanding of the EMP to the contractor and allow the CSC to work with the contractor to build environmental capacity. The CEMWP must include all the items listed in the EMP.

278. The CEMWP is to be completed by the contractor and submitted for approval to the Construction Supervision Consultant.

279. Since the contractor had no technical capacity at the time, CSC, in mid 2017, completed the CEMWP on behalf of the contractor,. This is now a working document and the contractor is submitting monthly checklists, based on a template provided by the CSC (see IEE Annex 3).

280. **Environmental Best Practice Guidelines/Plan (SSEMPs)**- In addition to the EMP, a set of topic specific best-practice guides or SSEMP Annexes were completed in 2017 and address the following areas:

Annex 1	Emergency Management Plan
Annex 2	Grievance Redress Mechanism
Annex 3	Plan For Safety, Health And Hygiene
Annex 4	Management Plan For The Life Of The Construction Camp
Annex 5	Waste Management Plan
Annex 6	Noise Management Plan
Annex 7	Old Asphalt Management Plan
Annex 8	Water Quality Management Plan
Annex 9	Air Quality Management Plan
Annex 10	Tree Management Plan for Sections 1-4 (Separate Volume due to size)
Annex 11	Dust Suppression Plan
Annex 12	Land Protection Management Plan
Annex 13	Environmental Protection Plan For The Construction And Reconstruction Of Bridges
Annex 14	Borrow Pit Management Plan

Annex 7 dealing with Waste Asphalt management was updated to address the placement of waste asphalt on 88 rural roads along the project corridor in 2018. It is attached to this IEE as Annex Document 4.

E. Mitigation and Monitoring Costs

281. **Mitigation-** Implementation of the mitigation measures defined in the EMP were estimated in 2015 as KGS 5.88 million (Table 27). Given the changes and large additions to the mitigation requirements, the 2017 estimate for EMP implementation, is estimated to have more than tripled to around KGS 18-20 million.

Table 27. Cost Estimate for Mitigation Measures 2015 (KGS)

Description	Unit	Quantity	Rate KGS	Amount KGS
Protection of Environment				
Preparation of the tree felling plan (recruitment of a forester technician)	months	1	30,000.0	30,000.0
Procurement of trees (5-7 year old)	Pieces	4,500	500	2,250,000.00
Planting of trees	Pieces	4,500	100	450,000.00
Maintenance and watering (during construction) as trees on the road side as explained in the EMP	Pieces	4,500	700	3,150,000.00
Tree protection during construction works (contractor's responsibility)				
Total				**5,880,000.0**

282. **Monitoring**- In 2015 the implementation of the monitoring activities was estimated at about KGS 800,000.00. The chagges to the mitigation requirements in 2017 and 18 added a further KGS 5,000,000.00 to that cost (Table 28).

Table 28. Cost Estimate for Monitoring Activities (KGS)

Description	No. Stations of one measurement	Measurement Cost (KGS)	No. Measurements a year	Total cost of monitoring measurements per 1 year (KGS)	Total cost of monitoring measurements during construction and the first year of operation (KGS)
<u>Monitoring measurements</u>					
Noise monitoring during the construction period (Bishkek – Kara-Balta)	16	5,104.00*	8	40,832.00	163,328.00
Dust and air pollution monitoring during construction period (Bishkek – Kara-Balta)	16	10,144.00**	8	81,152.00	324,608.00
Water quality monitoring (Bishkek – Kara-Balta)	6	9,216.00**	4	36,864.00	147,456.00
Total:		**25,568.00**		**158,848.00**	**635,392.00**
Special Monitoring Activities m 2017-2018				**TOTAL Special Costs**	**6,620,050.00**
Noise Modeling					*1,852,690.00*
Vibration Study					*2,117,360.00*
Added CSC costs for Noise and Vibration Study related work and Tree cutting and enumeration					*2,650,000.00*

* Rates of the Department for Disease Prevention and Sanitary-Epidemiology Supervision)
** Rates of the laboratory under the State Agency for Environment Protection and Forestry

VIII. STAKEHOLDER CONSULTATION AND INFORMATION DISCLOSURE

A. Stakeholder Consultations

283. To help MOTR achieve public acceptance of the project, the IEE included stakeholder participation and consultation. ADB requires one Consultation for category 'B' projects during project preparation stages and this was completed, albeit some years ago.

I. Consultation and Information Disclosure -2013

284. Public Consultation Meetings were held in June 2013 in Voenno Antonovka village, Sokuluk city, Belovodskoye village and Poltavka village. Results of the consultation meetings are attached in the Annex and summarized in Table 29. A second set of meeting were conducted on June 2018 and records of that session are summarized in Table 30.

285. MOTR will prepare other environment-related documents available in accordance with Kyrgyz and ADB requirements for disclosure. Timing of disclosure is scheduled immediately after approval of the IEE by the State Ecological Expertise of the State Agency of Environmental Protection16.

286. After Finalization the IEE reports documenting the mitigation measures and consultation process will be submitted to MOTR and ADB and will be disclosed on ADB and IPIG/MOTR websites.

[16] Approval of the 2015 IEE was in fact provided by both ADB and the Government of Kyrgyzstan.

Table 29. Summary table on public consultation for the Bishkek to Kara Balta Section

Time	Venue	Participants	Issues discussed	Answer and suggestions for incorporation
June 10, 2013. 10:20 am to 11:45 am	Belovodskoje town, Conference hall of Moscowskiy Rayon Administration	IPIG/MOTR Asylbek Abdygulov Safeguard Specialist Kock's Consult Vasiliy Chernyh Deputy Team Leader, Nurul Hoque Sociologist Erik Shukurov Ecologist	Duration of road construction.	Duration will be three years.
			What will be the amount of compensation?	The compensation size will be determined additionally during the resettlement commission work, while preparing a detailed design.
			What is the forecasted traffic flow increase?	Estimated increase of road flow capacity is 4% per year over the next 20 years.
			What about construction of a by-pass road?	Construction of a 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.
			How will the issue on cut plantations be solved?	First the owners of the trees to be cut will be identified. Upon implementation of the project all cut trees will be rehabilitated/compensated as 1:10. 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. Only local and drought-resistant species of trees and bushes would be planted.

Time	Venue	Participants	Issues discussed	Answer and suggestions for incorporation
			What is the width of the designed road? What about the communication lines?	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 that are in bad conditions will be replaced. After replacement, the old ones will be handed over to local authorities. All power lines will be replaced with new ones – new posts would be erected as well as new lines. Only after complete replacement and reconnection of power lines the old ones will be demolished.
			What is the total cost of the project? Then Abdygulov Asylbek 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. To enhance awareness among the people it is planned to distribute informative brochures containing information on social, economical and engineering aspects of the Bishkek-Osh road rehabilitation project.	Total cost of the project is approx. US$ 209 million.
June 11, 2013, 14:30 pm to	Petropavlovka village	IPIG/MOTR Asylbek Abdygulov Safeguard Specialist	Who will be the contractor?	The contractor will be determined based on results of the tender. It could be both local and foreign company.

Time	Venue	Participants	Issues discussed	Answer and suggestions for incorporation
16:10 pm		Kock's Consult Vasiliy Chernyh Deputy Team Leader, Nurul Hoque Sociologist Erik Shukurov Ecologist	How will the construction works influence on the environment of Petropavlovka 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.
			What is the width of the designed road? What about the communication lines?	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 that are in bad conditions will be replaced. After replacement, the old ones will be handed over to local authorities. All power lines will be replaced with new ones – new posts would be erected as well as new lines. Only after complete replacement and reconnection of power lines the old ones would be demolished
			What is the total cost of the project?	Total cost of the project is appr. $ 209 million (in 2013).
June 10, 2013, 14:15	Sokuluk village, conference hall of Sokuluk ayil okmotu	IPIG/MOTR Asylbek Abdygulov	Will the channel lines near the road in Shopokov street be destroyed or otherwise impacted?	All communication and channel lines will be either shifted or equipped by protective coats.

Time	Venue	Participants	Issues discussed	Answer and suggestions for incorporation
pm to 15:40 pm		Safeguard Specialist Kocks Consult Vasiliy Chernyh Deputy Team Leader, Nurul Hoque Sociologist Erik Shukurov Ecologist	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.
			What about the traffic lights, street lighting? Will they be provided? How will the road pavement and adjacent territory look?	Traffic lights and 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. Number of bus stops will be increased and re-equipped. 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 appr. 18 years.
			How will the old asphalt be utilized? V. Chernyh.	The old asphalt will be used in the following way: 50% for construction needs and 50% for the needs of local people (repair of feeder roads and others).

II. Consultation and Information Disclosure 2018

287. On June 8th, 2019 three public consultation meetings were organized and completed by IPIG. This session was attended by the following officials and no known attendance record was prepared.

IPIG

Ruslanbek Satybaldiev	Director, IPIG
Asylbek Abdygulov	Environmental Specialist, IPIG
Team of Engineers	

Eptisa Servicios De Ingenieria, S.L.

Hakan Nemutlu	Team Leader
Team of Engineers	

China Railway No. 5

Lai Xiangde	Project Manager
Team of Engineers	

288. Three public meetings were held in Sokuluk and Bealvodskoe villages, mainly to inform the local people that construction work will re-start with no vibration. The ADB Mission attended the meetings held in Sokuluk and Belovodskoe villages, as observers.

289. IPIG prepared minutes of these meeting, which are attached as an annex to this IEE. A summary of these meetings and site visits was prepared and defined concerns raised and actions to be taken by the IPIG, the contractor and the CSC-EPTISA.

Table 30. Summary of Concerns raised at June 8, 2018 consultations and actions to be taken

Forum	Location	Issue	Who Raised the Issue	Action Needed	EPTISA Recommendation (complete by July 31, 2018)
Public Meeting	Sokuluk v.	Vibration from road construction	Roadside residents	IPIG/MOTR to explain that no vibration in use-possible damage due to regular traffic and poor dwelling construction	No action needed
		Too many trees being cut	Roadside community	Careful re consideration of an future tree cutting, e.g. 8-5-15.9 and reduction	Revise design to minimize tree losses from estimated 4000 to 1000.
		Municipality not informed on project issues, e.g. project stoppage	Municip officials	IPIG/MOTR needs to provide regular updates	Update needed
		Municipality requesting crosswalk amber lights and stoplights at school crossings	Municip.officials	IPIG/MOTR needs to address and permit CSC to make design adjustments to include these safety features	IPIG/MOTR engineers to design crosswalk and stoplights, EPTISA to finalize
		Payment for gravel extracted from Sokuluk borrow site not made	Municipal official	Notice to contractor to pay, provided that material is owned by government	IPIG Determine who owns the gravel.
		Request by municipality wants to use old asphalt on secondary roads	Municipal officials	Municipal officials to provide list of roads and confirmation of approval from roadside residents—then submit list to IPIG/MOTR	EPTISA to obtain written approvals concerning old asphalt management
	Novonikolaevka v.	What mitigation measures are in place to address vehicle parking and roadside market area use during reconstruction work and during the operation of the upgraded road?	Municipal officials	IPIG/MOTR to instruct EPTISA to develop best options for managing this issue , which will be extreme once roadwork begins in the three towns.	IPIG/MOTR to discuss mitigation options with EPTISA and Social Sector Spec. Draga V. and develop several options then hold public consultations to decide on a preferred and feasible approach
		Which if any secondary roads will be rehabilitated as part of this work, [including intersections]?	Municipal officials	IPIG/MOTR and municipal officials to decide which secondary roads to be rehabilitated and level of work-provide list to EPTISA	IPIG to provide list and details and EPTISA to conduct assessment
		Construction related dust	Municipal official	IPIG to instruct CSC to establish where dust is occurring and why contractor not watering adequately	EPTISA to revisit dust management with contractor and send letter to increase watering frequency
		Improper waste (type???) disposal	Municipal officials	Contractor environmental monitor to consult with municipal officials and establish type and location of	Contractor's monitor to report weekly to EPTISA concerning waste disposal at construction work camp and

Forum	Location	Issue	Who Raised the Issue	Action Needed	EPTISA Recommendation (complete by July 31, 2018)
				inappropriate waste disposal.	contractors camp.
		Misc Issues; Sugar factory and sewage system rehabilitation?	Municipal Official		
	Belavodskoe v.	Vibration damage (same people as earlier) and no compensation or repair action initiated	Roadside residents	IPIG/MOTR to instruct CSC prepare semble a vibration damage repair plan	EPTISA's Draga V. to prepared draft plan. Need to know dates of when damage occurred, etc.
		Dust emissions			Prepare a watering schedule
		Use of old asphalt on secondary roads			
		Roadside safety such as crosswalk lights, stoplights as school crossings			Add to design being prepared by MOTR/IPIG and EPTISA
		Poor communication between IPIG and public	Community and officials	Prepare brochures and make announcements when there are major changes	IPIG to prepared monthly regular update to municipalities involved (mail message)
		Tree replanting plan and schedule to roadside residents	Community and officials	Organize information on tree replanting and distribute to local communities	EPTISA to prepare material if required

Note: The minutes prepared by IPIG included meeting record as well as results of site visit and ADB observations,. These have been included in the meeting record included as an Annex to this IEE Update.

IX. Grievance and Redress Mechanism

A. Objectives

290. Grievance redressing mechanism will be established to allow APs appealing any disagreeable decision, practice or activity arising from implementation of Rehabilitation of 45.1 km Bishkek~ Kara Balta and 67 km Madaniyak - Jalalabad roads under 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.

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

B. Grievance Redress Group

292. 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.

C. Functioning of the GRG within the Grievance Redress Mechanism

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

1. **Stage 1, Local (Village) Level-** 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.

2. **Stage 2, Central Level-** 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.

294. 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.

295. 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.

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

297. **Local Level GRG**- will be established at each Ayil-Okmotu along the project roads with the provision of members of following composition.

Table 31.: 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

298. Central level GRG- The central level GRG will be represented by 6 members of the following composition.

Table 32. 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

299. 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
- 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

D. Duties of GRG Members

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

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

i. 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;
ii. 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;
iii. request village authorities to organize the meeting(s)
iv. chair the GRG meetings;
v. convey requests and enquiries of the complainants to IPIG/MOTR and to the other members of the GRG at village level;
vi. maintain records of each meeting and each communication between him/her and the complainants;
vii. participate as a witness to appeal cases at all levels;
viii. ensure the administrative and organizational support for GRG members to work;
ix. disseminate the information on the GRM across the local communities concerned.

RMU Representative

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

i. contact the complainant(s) and draft a note with his/her understanding of the complaint;
ii. recording of complaints and submitted documents of proof;
iii. participate to all grievance meetings, provide opinions and analysis, take minutes of the discussions
iv. accompany eventual assessment/valuation specialists in the field
v. 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.
vi. 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.
vii. 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

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

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

Ombudsman

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

i. monitor complaint handling process and ensure that decisions made by the GRP are equitable and objective;
ii. provide independent opinions and recommendations related to the decision made on the case by the GRP team;
iii. advise the complainant(s) on their rights and entitlements, as necessary;
iv. participate to all GRG meetings and site visits;
v. participate in eventual assessment/valuation in the field;
vi. 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 of MOTR

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

i. contact the complainant(s) and draft a note with his/her understanding of the complaint;
ii. trigger the GRG members through a letter of invitation;

iii. chair the GRG meetings and ensure that minutes of the meeting are shared with all relevant parties;
iv. review the content of each response prepared after deliberations to ensure accuracy as well as consistency of answers provided to the complainants;
v. ensure the administrative and organizational support for GRG members to work;
vi. support the decision made by the GRG and ensures that the follow-up actions are taken.

IPIG Project Coordinator

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

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

Representatives of IPIG Safeguards Unit

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

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

Technical Experts

307. 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:

i. provision of relevant technical opinion for the case reviewed;
ii. carry out the needed investigations relevant to their expertise;
iii. provide recommendation when the legal opinion from the relevant state agencies is necessary.

E. Grievance Resolution Process

308. The LPC of GRGs will be regularly available and accessible for APs to address concerns and grievances (Table 33). 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 33. Grievance Resolution Process

Steps	Action level	Process
Step 1	Negotiation	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 with local GRG within 7 days.

Step 2	GRG Resolution	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 decision will be communicated to the complainant AP by the IPIG Project Coordinator within 15 days of submission.

309. 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.

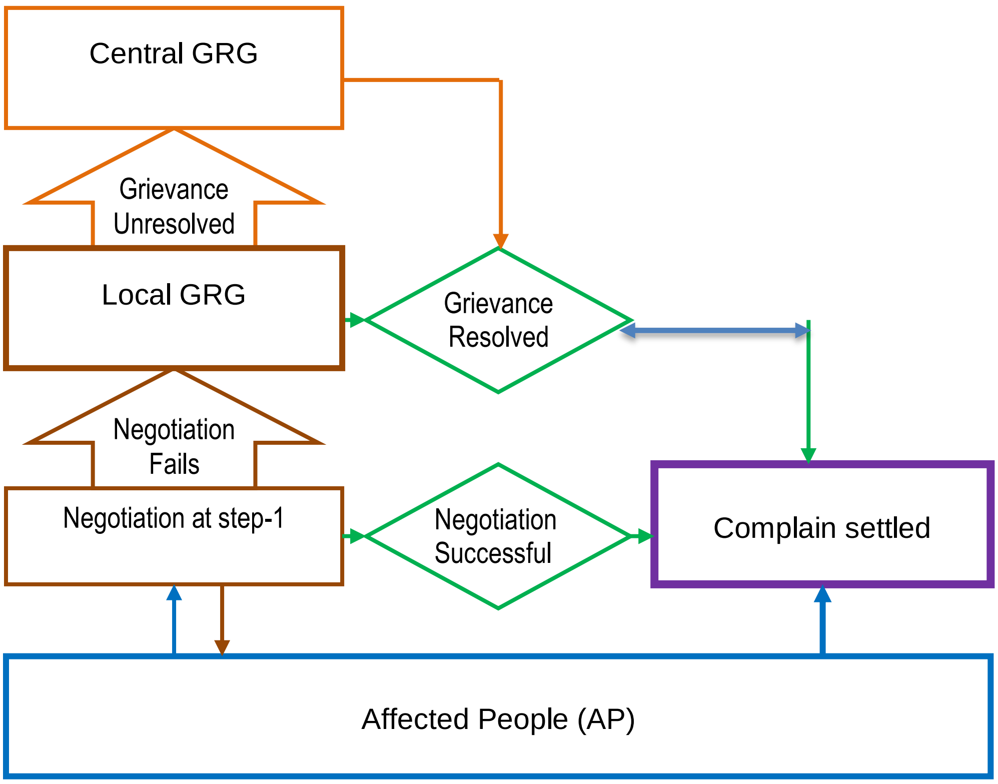


Figure 10: Grievance redress process

F. GRG Records and Documentation

310. 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.

G. 2017 Update

311. To assist with the implementation of the Grievance Redress Process, a special guideline was prepared and referred to as SSEMP Annex 2, Grievance Redress Mechanism and has been included in the IEE documentation, approved by ADB in 2017.

To date, grievances concerning the vibration damage have not followed this process, however all future resolutions will follow the process as defined in the IEE.

X. CONCLUSIONS AND RECOMMENDATIONS

A. Conclusions

312. The Bishkek–Kara Balta road project will rehabilitate an important part of the transport corridor across the Kyrgyz Republic, in fact the most heavily travelled section of highway on the country. It will improve the country's competitiveness by improving the central transport corridor. The better road design and 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.

313. 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.

314. 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 200 culverts and 6 bridges along the route. The IEE and its EMP have provided the steps necessary to avoid many of the construction period impacts, by developing good protocols and work programs for managing potential impacts, and will be implemented.

315. During the preconstruction period the eight key tasks to be implemented by MOTR, 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. Handling and reprocessing of >1 million m3 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. Tree Inventory, identification of special groves, protection where possible , and completion of a replanting plan;
7. Inclusion in road design of public safety and public services features, namely:
    - Pedestrian crossings and traffic lights
    - Lighting signage and sidewalks
    - Bus stops
8. Provision of technical capacity building.

316. During the construction period the contractor, guided by CSC and IPIG, will need to:

1. Prepare a Construction Environmental Management Workplan (CMWP) and Best Practice Guidelines, based on the IEE and its EMP (100% completed,)
2. Undertake Air Quality and noise and water quality field-testing for the full three years and one operating year.
3. Prevent and clean up all petroleum products and bitumen spills, including proper disposal.
4. Contractor to manage sewage and garbage at work sites at all time
5. Contractor 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.
6. Maximize the reuse or redistribution of the old asphalt by applying guidelines found in SSEMP Annex 7 (Annex 4 in this IEE).

7. 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.
8. Implement dust suppression program on all haul roads and at construction sites
9. Understand and implement all regulations standards and obtain licenses for all borrow site operations and rehabilitation.
10. Enforce occupational health and safety requirements as prescribed by law and ILO standards;
11. 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.
12. Rehabilitate and stabilize all borrow site areas used during the construction
13. Make certain that the new asphalt pavement is the noise attenuation formulation as prescribed by the CSC.

317. During year 1 of the operating period (defect period) the CSC and Contractor, with input from the IPIG, will:

1. Make certain that all replanted trees are healthy and properly maintained and protected for the winter—this may require strengthen the RMU as there will be up to 10,000 trees to manage.
2. Prepare a photo record of all culverts, confirming proper placement, downstream drainage and debris removal
3. Continue the air quality and noise monitoring for the year
4. Examine noise-modelling data collected and plan noise attenuation measures should exceedances occur.
5. Inspect decommissioned borrow areas to confirm rehabilitation and proper closure.
6. Inspect roads that received waste asphalt to be sure that drainage has not been blocked and that access for roadside residences is fully restored
7. Monitor effectiveness of pedestrian crossing and bus stops, with a view to adjustments/improvement as needed.
8. Prepare environmental safeguards completion report.

318. **2017 Update- Noise** A special noise study was undertaken to better identify noise effects on roadside residents and businesses during the construction and operation periods and the define best available mitigation measures to keep noise levels within acceptable Kyrgyz and international standards. This noise report indicated that baseline noise levels were 15-17 dBA above Kyrgyz and IFC standards. The construction period noise levels were estimated to increase intermittently by1.5-5.8 dBA for 90% of the time and up to 8 dBA when all equipment was operating at the same time (10% of the time). By laying down noise attenuating asphalt the 139 structures (of the >4350 tested) where the IFC+3 dBA formula had been exceeded, were brought into compliance.

319. **2018-Update-Vibration**- Due to complaints filed by local residents that the use of vibratory compactors was causing both cosmetic and structure damage to roadside dwellings, a vibration study was completed. The study established that dwellings constructed of adobe brick and within 16m of the vibration source were at risk of developing both cosmetic and structural cracks.

320. Using that study a vibration management plan was discussed, including the purchase of vibration monitoring equipment that would alert operators of exceedances of the threshold vibration levels determined to cause damage to roadside dwellings, as well as the construction of trenches between the roadwork and dwellings.

321. Given the large number roadside dwellings at risk, the complexities and cost of installing and implementing of such a vibration alert system, MOTR, with advice from EPTISA and with ADB’s agreement, decided that only non-vibratory compaction would be used, effectively eliminating the construction-related vibration impact.

B. Recommendations

322. The CEMWP and its environmental checklist prepared by the contractor, will be the working monitoring guide, supported by the 15 SSEMP-Annexes , which have been listed in the first column of the CEMWP for easy reference. The CEMWP will be carefully applied and will require monthly reporting using the Checklist.

323. MOTR/IPIG will instruct the contractor to provide at least monthly environmental monitoring reports, using the CEMWP Checklist prepared by CSC.

324. MOTR/IPIG will instruct the contractor to retain a full-time environmental safeguards monitor as well as an occupational health and safety specialist to address the wide range of activities being undertaken by the contractor,

325. CSC and IPIG will deliver at least two training session on the use of the CEMWP, environmental monitoring, report preparation, and including the conduct of field inspections of all work activities and involving the contractor and IPIG staff.

326. MOTR/IPIG will instruct the contractor that non-compliance notices must be addressed fully and with specific detail in the time specified or face stiff penalties , including cessation of work on the component where the non-compliance has arisen.

327. IPIG and MOTR will instruct the contractor that all compaction must be completed using only non-vibrating rollers.

328. During the post-construction defect period (usually the first operating year), the CSC and contractor will conduct a safeguards compliance check to be sure that all measures required of the contractor have been met, and will prepare a final compliance report.

ANNEXES

The SSEMP-Annexes

Due to the total length of the 15 SSEMP-Annexes (>1000 pages) ,and since they were approved prior to the final IEE update, this IEE contains only references to the annexes, except updates to SSEMP Annex 6 and 7 included in the IEE. The Annexes are provided in two volumes (Annex 10 the Tree Replanting Plan being a single volume) with the CEMWP**.**

Annex 1: Public Consultation Meetings

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

Date: June 11, 2013

Place of meeting: Belovodskoye town, Moscowskiy rayon, Chuiskaya oblast, Conference-hall of Moscowskiy Rayon Administration

Meeting started: 10.20

Meeting ended: 11.45

Presented:

IPIG/MOTR

Asylbek Abdygulov	Safeguard Specialist

CONSULTANT «KOCKS CONSULT GMBH»

Vasiliy Chernyh	Deputy Team Leader
Nurul Hoque	Sociologist
Erik Shukurov	Ecologist

LOCAL COMMUNITY (List is attached).

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 Belovodskoye town). 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: How long the road construction will last?

V. Chernyh. Total project implementation period is approximately three years. Besides the construction works will start simultaneously in several sections.

Question: What will be the amount of compensation?
Asylbek: The compensation size will be determined additionally during the resettlement commission work, while preparing a detailed design.

Question: What is the forecasted traffic flow increase?

V. Chernyh. Estimated increase of road flow capacity is 4% per year over the next 20 years.

Question: What about construction of a by-pass road?
V. Chernyh. This option was discussed. Construction of a new road is double expensive then rehabilitation of old road pavement. Besides there is a moratorium on seizure and transformation of the agricultural land.

Question: Will be the subways, drainage structures, auxiliary roads rehabilitated/constructed to relief the main road?
V. Chernyh explained that the subways would be rehabilitated: extended, strengthened, 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.

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/compensated as 1:10. 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. Only local and drought-resistant species of trees and bushes would be planted.

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. All power lines will be replaced with new ones – new posts would be erected as well as new lines. Only after complete replacement and reconnection of power lines the old ones will be demolished.

Question: What is the total cost of the project?

V. Chernyh. Total cost of the project is appr. $ 209 mln.

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. To enhance awareness among the people it is planned to distribute informative brochures containing information on social, economical and engineering aspects of the Bishkek-Osh road rehabilitation project.

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.

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

Date: June 11, 2013

Place of meeting: Petropavlovka village, Dzhayilskiy region, Chuiskaya oblast, Conference-hall of Petropavlovskiy local administration.

Meeting started: 14.30

Meeting ended: 16.10

Presented:

IPIG/MOTR

Asylbek Abdygulov	Safeguard Specialist

CONSULTANT «KOCKS CONSULT GMBH»

Vasiliy Chernyh	Deputy Team Leader
Nurul Hoque	Sociologist
Erik Shukurov	Ecologist

LOCAL COMMUNITY (List is attached).

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 Petropavlovka 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: How long the road construction will last?

V. Chernyh. Total project implementation period is approximately three years. Besides the construction works will start simultaneously in several sections.

Question: Who will be the contractor?
V. Chernyh: The contractor will be determined based on results of the tender. It could be both local and foreign company.

Question: : What will be the amount of compensation?
Asylbek: The compensation size will be determined additionally during the resettlement

commission work, while preparing a detailed design.

Question: What about construction of a by-pass road?
V. Chernyh. This option was discussed. Construction of a new road is double expensive then rehabilitation of old road pavement. Besides there is a moratorium on seizure and transformation of the agricultural land.

Question: Will be the subways, drainage structures, auxiliary roads rehabilitated/constructed to relief the main road?
V. Chernyh explained that the subways would be rehabilitated: extended, strengthened, furnished. After the rehabilitation they would be maintained by local governments. Also the project includes construction of sidewalks, channels and drainage chutes.

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/compensated as 1:10. 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. Only local and drought-resistant species of trees and bushes would be planted.

Question: How will the construction works influence on the environment of Petropavlovka village? What about the current situation with maximum permissible concentration of harmful substances in vehicle emissions, noise and vibration? Is there is an excess?
Asylbek: 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.
E. Shukurov. 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.

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. All power lines will be replaced with new ones – new posts would be erected as well as new lines. Only after complete replacement and reconnection of power lines the old ones would be demolished.

Question: What is the total cost of the project?
V. Chernyh. Total cost of the project is appr. $ 209 mln.

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. To enhance awareness among the people it is planned to distribute informative brochures containing information on social, economical and engineering aspects of the Bishkek-Osh road rehabilitation project.

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.

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

Date: June 10, 2013

Place of meeting: Sokuluk village, Sokulukskiy rayon, Chuiskaya oblast, conference-hall of Sokuluk ayil okmotu

Meeting started: 14.15

Meeting ended: 15.40

Presented:

IPIG/MOTR

Asylbek Abdygulov	Safeguard Specialist

CONSULTANT «KOCKS CONSULT GMBH»

Vasiliy Chernyh	Deputy Team Leader
Nurul Hoque	Sociologist
Erik Shukurov	Ecologist

LOCAL COMMUNITY (List is attached).

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 Sokuluk). 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 the channel lines near the road in Shopokov street be destroyed or otherwise impacted?
V. Chernyh explained that all communication and channel lines will be either shifted or equipped by protective coats.

Question: Will be the subways rehabilitated?
V. Chernyh explained that the subways would be rehabilitated: extended, strengthened, furnished. After the rehabilitation they would be maintained by local governments.

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. 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.

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. Only local and drought-resistant species of trees and bushes would be planted.

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. All power lines will be replaced with new ones – new posts would be erected as well as new lines. Only after complete replacement and reconnection of power lines the old ones would be demolished.

Question: What about the traffic lights, street lighting? Will they be provided? How will the road pavement and adjacent territory look?
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. Number of bus stops will be increased and re-equipped. 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 appr. 18 years.

Question: How will the old asphalt be utilized?

V. Chernyh. The old asphalt will be used in the following way: 50% for construction needs and 50% for the needs of local people (repair of feeder roads and others).

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. To enhance awareness among the people it is planned to distribute informative brochures containing information on social, economical and engineering aspects of the Bishkek-Osh road rehabilitation project.

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.





Minutes of the Public Consultation Meeting
under the CAREC Corridor 3 (Bishkek-Osh Road) Improvement Project, Phase 4
Road Sections: Bishkek-Kara-Balta and Madaniyat-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 (List is attached).

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.

Minutes of
the holding of public hearings
on the construction of Bishkek-Kara-Balta road section project

June 08, 2018 **Sokuluk village**

Venue: club of Sokuluk village, 09.30

Participants:

Sadaliev U.	- First Deputy Head of Sokuluk rayon state administration
Satybaldiev R.A.	- Director of the IPIG under the MOTR KR;
Aliev M.B.	- Specialist on land issues and architecture of the IPIG under the MOTR KR;
Abdygulov A.	- Environmental specialist of IPIG under the MOTR KR;
Kartanbaeva N.	- Safeguard measures specialist / sociologist IPIG under the MOTR KR;

from EPTISA:

Toktomambetov A.D.	- Deputy Team Leader;
Dolgov Yu.Yu.	- Resettlement specialist;
Glinov V.	- translator;

from Contractor:

Lai Xiangde	- Head of the Contractor;
Abirchoroev M.	-Public Relations specialist of the Contractor;
Kamchybekov M.	- Translator;

28 people - invited residents of the Sokuluk district and representatives of organizations

Agenda:
Information on the construction project of the Bishkek-Kara-Balta road section, in particular, the modification of the method for compaction of the road embankment without using vibration.

Issues and discussions:

Introductory speech:
Information on the project was presented by R. Satybaldiev. Information was provided on the construction project of the Bishkek-Kara-Balta road section and the ongoing work under the current project. An explanation was given regarding the activities carried out in the scope of studying vibration impact after complaints received in 2017. Explanation was given regarding works which were carried out to study the issue of vibration (necessary studies) with the involvement of local specialists (Institute of Seismology of the National Academy of Sciences of Kyrgyzstan, State Institute of Antiseismic Construction and Engineering Design under the Government), as well as an international specialist hired by the consulting company EPTISA.

Issue 1: Mayor of Shopokov city. Insufficient information on the project for the construction of the road section. Where and how many traffic lights will be installed? Previously 2 requests for traffic lights were submitted.

Response:
This question is incorrect, because before the start of the project, all the necessary information was provided, and the wishes of the local authorities were taken into account. On the site of Shopokov city, traffic lights will be installed only on the main streets adjacent to the Bishkek-Osh road, taking into account the requirements of road safety and the approval of the State Traffic Police of the Ministry of Internal Affairs of the Kyrgyz Republic. For more precise information, you can get from

the assistant of the Consultant's resident engineer (the contact details of the consultant's representative were given to the municipality of Shopokov).

Issue 2: asphalt on the other streets

Response:
Excavated old asphalt will be used for the filling of the on-site roads in the villages. The Contractor has started to carry out this work, in addition the Contractor will repeatedly send the request to the District Administration and ayil okmotu to clarify the list.

Issue 3: width of the roadway.

Response:
The project for the reconstruction of the Bishkek-Kara-Balta road section is classified as a 1st category (4 lanes) with the arrangement of roadsides, parking lots, new sidewalks, drainage trays, new pedestrian crossings with the installation of traffic lights, construction of new underground transitions (mainly at school locations) and rehabilitation of old ones. The width of the roadway will be 28 meters (3.5 m. Four lanes-two lanes in both directions). In addition, divider barriers "Jersey" will be installed.

Issue 4: Using the old asphalt to lay it on the road inside the landfill.

Response:
The use of old asphalt to fill the on-site roads is permissible. The contractor began to carry out this work, in addition, the Contractor will repeatedly send the request to the District Administration and specify the list of streets to which the old asphalt will be removed to improve the condition of the on-site roads.

Issue 5: from the representative of OJSC Kyrgyztelecom on the relocation and installation of cable lines and wells falling under the expansion of the road.

Response:
The project on the relocation of air and underground cables was taken into account and provided for in the project and agreed with the district department of Kyrgyztelecom. All communication lines will be relocated within the framework of the approved and agreed upon earlier project, with the exception of additional communication lines. All additional relocation work must be coordinated with the Consultant. Earlier your question was already raised with the Consultant and the Contractor. All questions prior to the beginning of the work will be agreed with you, during the start of work on the relocation, Contractor will invite your experts to the site.

Issue 6: on the mudflow/drainage pipes. The number of pipes, and whether you can give the removed old reinforced concrete circles for the needs of local authorities.

Response:
Within the framework of this project it is planned to replace old and construct new drainage pipes of different diameters and shapes. I do not know exactly the exact number, but I would like to note that additionally drainage pipes will be installed at each off-ramp at the areas adjoining the Bishkek-Osh road. Old reinforced concrete circles after dismantling are transferred to the ROE according to the act. You need to contact the "Bishkek-Osh" State Administration and solve this issue with them.

Issue 7: on the Jelamysh borrow pit on the territory of Gavrilov ayil okmotu and on asphalting of the road in the Gavrilovka village. Will there be payments to the local budget for the development of borrow pits and whether social packages are provided.

Response:
As part of the signed contract between the MOTR KR and the Chinese company CR # 5, the Government of the Kyrgyz Republic is obliged to provide places for borrow pits. No payments are provisioned. Social package is not provided, since it is not the development of mineral products, there is a development of a borrow pit for the development of inert material for the construction of an object for the needs of the Kyrgyz Republic. Under this contract, the Contractor is required to maintain access roads to the borrow pits by preliminary drawing up an act on the condition of this road and obtaining consent from local government authorities. New asphalting is not provided for, but the Contractor will work to bring the road to its original state and improve the condition of the road used to transport the inert material from the borrow pit to the project site.

Issue 8: on noise and vibration during the construction works and driving of vehicles. At the present time there is a strong noise and vibration when driving of heavy vehicles.

Response:
Taking into account received complaints and conducted research on vibration, it was decided to change the methods of work and carry out work on compaction without vibration, by increasing the number of passes of rollers. At the present time, due to the poor condition of the road (the presence of pits, patches from patching works and unevenness of the road), a so-called dynamic impact from tires under the weight of a motor vehicle occurs during the passage of heavy vehicles. After the completion of the construction of the road due to the laying of a new base and a new asphalt (fine-grained asphalt), there will be a reduction in noise and vibration arising from driving vehicles.

Issue 9: does fence of the store "Oil Change" in the Sokuluk village fall under the impact of the project?

Response:
The applicant was repeatedly notified about the absence of an impact on the fence of the store "Oil Change".

Issue 10: Tree cutting in the Gavrilovka village.

Response:
Tree cutting on the Section 1.1 was completed in 2017. In the current year, work will begin to set out the center and the road cross section in the remaining areas, after which work will begin on marking the trees falling under the cutting. The Contractor will receive the appropriate permission to cut trees and after the receipt of approval from ADB, the work on cutting down the trees will be started. All the cut down trees are transferred to the local government by the Contractor. Within the framework of the current project, compensatory measures are envisaged in the part of planting new trees at suitable sites along the road at the rate of 1: 3.

Minutes of
the holding of public hearings
on the construction of Bishkek-Kara-Balta road section project

June 08, 2018 Belovodsk village

Venue: The Event Hall of the Moscovsky Region Administration, 11.00

Participants:

Esenbekov A.E.	- Head of Moskva rayon state administration
Serdukova I.V.	- First Deputy Head of Moskva rayon state administration
Satybaldiev R.A.	- Director of the IPIG under the MOTR KR;
Aliev M.B.	- Specialist on land issues and architecture of the IPIG under the MOTR KR;
Abdygulov A.	- Environmental specialist of IPIG under the MOTR KR;
Kartanbaeva N.	- Safeguard measures specialist / sociologist IPIG under the MOTR KR;
om EPTISA:	
Toktomambetov A.D.	- Deputy Team Leader;
Dolgov Yu.Yu.	- Resettlement specialist;
Glinov V.	- translator;
from Contractor:	
Lai Xiangde	- Head of the Contractor;
Abirchoroev M.	- Public Relations specialist of the Contractor;
Kamchybekov M.	- Translator;

40 people - invited residents of the Moscovsky region and representatives of organizations

Agenda:

Information on the construction project of the Bishkek-Kara-Balta road section, in particular, the modification of the method for compaction of the road embankment without using vibration.

Issues and discussions:

Introductory speech:

Information on the project was presented by R. Satybaldiev. Information was provided on the construction project of the Bishkek-Kara-Balta road section and the ongoing work under the current project. An explanation was given regarding the activities carried out in the scope of studying vibration impact after complaints received in 2017. Explanation was given regarding works which were carried out to study the issue of vibration (necessary studies) with the involvement of local specialists (Institute of Seismology of the National Academy of Sciences of Kyrgyzstan, State Institute of Antiseismic Construction and Engineering Design under the Government), as well as an international specialist hired by the consulting company EPTISA.

<u>Issue 1</u>*: from the representative of Petrovsky ayil okmotu on the cracks in houses in the Oetrovka village caused by cars*

Response:

After the received complaints on the cracks submitted in 2017, work was carried out to study the issue of vibration with the involvement of local specialists (Institute of Seismology of the National Academy of Sciences of Kyrgyzstan, the State Institute of Antiseismic Construction and Engineering Design of the Republic of Kazakhstan), as well as an international specialist hired by EPTISA Consulting Company. According to the report of the Institute of Seismology of the NAS of the Kyrgyz Republic and IACED, there is no clear definition of the causes of possible cracks. According to these reports, it is explained that the appearance of cracks could be affected by the poor current condition of houses (partial heating of houses in winter, untimely maintenance, etc.), construction of houses with violation of SNiP requirements (depth of foundation, materials used in construction and etc.), the near occurrence of underground groundwater, as well as past earthquakes with small shakes for a given period. The international specialist involved measured the vibration level from the Contractor's working equipment, in particular for the road roller, the vibration level and speed were measured under different operating conditions (vibration-free operation, low vibration operation and maximum vibration operation). The measurements made showed that the operation of the roller with the use of vibration does not damage the structure, which can lead to the destruction of the building. The effect of vibration on the occurrence of cracks is possible, but there are additional factors that affect the occurrence of cracks. After the complaints received, all compaction operations were suspended and on the basis of recommendations specified in the report, it was decided to produce a compaction without vibration.

Issue 2: at whose expense the pavilions are dismantled in the village of Aleksandrovka after the end of the right to use the land plot (upon the expiry of the lease term of the land plot provided by local self-government bodies).

Response: the representative of the State Ecological Inspectorate of the Moscovsky region explained that in accordance with the Law of the Kyrgyz Republic and in accordance with the contract for the lease of the land plot, upon the expiration of the lease term, the lessee must bring the leased area to the "initial" state and dismantle at his own expense.

Issue 3: on the exclusion zone for construction 32 m from the axis of the road.

Response:
the representative of the State Ecological Inspectorate of the Moscovsky District explained that in accordance with the Regulation of the Government, a moratorium was imposed on the issuance and approval of permits for the construction of facilities located 32 m from the road axis before the end of the project implementation.
Satybaldiev R. added that this requirement does not apply to objects located 32 meters from the axis of the road, in any case, all planned work along the project site should be coordinated with the IPIG and the Consultant.

Issue 4: the terms of the construction of the road on certain sections (on the territory of the district or a separate ayil okmotu).

Response:
At the moment, in accordance with the modified working procedure (work on compaction without vibration), the Contractor updates its work schedule. You can contact the Construction Supervision Consultant permanently on the site or we can give you this information. I would like to note that the term specified in the schedule may vary, because you have to understand that construction works and sometimes there are unforeseen problems, for example, underground communications not indicated in the schemes. But the Contractor will try to carry out this work schedule, we and Consultant will control these works in order to minimize discomfort to the local population.

Issue 5: the question is from a resident of Sadovoe village. Maybe it is necessary to determine a certain amount which, for example, about 50 thousand soms and give them to the owners of houses along the road, that the residents themselves would carry out a "cosmetic" repair of houses.

Response:
No amount is provided for distribution among residents of houses. A certain amount is provided for the payment of compensation to persons whose property is affected by the project. We cannot do what you suggest, since any payment must be justified and documented. If, you mean the occurrence of cracks through the fault of the Contractor, prior to the commencement of work, a visual inspection and fixation of existing cracks will be carried out and in case of confirmation of the formation of cracks, this issue will be solved and discussed with each individually.

Issue 6: The wish of the local population to hold regular meetings to discuss the issues of construction time and issues arising during construction.

Response:
We will try to organize such meetings on the part of the IPIG together with the district administration of the district more often, but you can contact the heads of aiyl okmotu who are the local contact person through whom information can be obtained or you can send us a request.

Issue 7: In the Petrovka, Sadovoe and Belovodsk villages do not construct underground passages, due to a close occurrence of the groundwater level, it is better to arrange aboveground underground pedestrian crossings with the installation of traffic lights.

Response:
Within the framework of the current project, it is planned to repair the existing underground pedestrian crossings and to construct a new underground pedestrian crossing in the center of the village of Belovodskoye. Thank you very much for your comment, this issue will be further studied and a decision made.

Issue 8: Vibration measurement in Petrovka village.

Response:
After the received complaints on the cracks submitted in 2017, work was carried out to study the issue of vibration with the involvement of local specialists (Institute of Seismology of the National Academy of Sciences of Kyrgyzstan, the State Institute of Antiseismic Construction and Engineering Design of the Republic of Kazakhstan), as well as an international specialist hired by EPTISA Consulting Company. According to the report of the Institute of Seismology of the NAS of the Kyrgyz Republic and IACED, there is no clear definition of the causes of possible cracks. According to these reports, it is explained that the appearance of cracks could be affected by the poor current condition of houses (partial heating of houses in winter, untimely maintenance, etc.), construction of houses with violation of SNiP requirements (depth of foundation, materials used in construction and etc.), the near occurrence of underground groundwater, as well as past earthquakes with small shakes for a given period. The international specialist involved measured the vibration level from the Contractor's working equipment, in particular for the road roller, the vibration level and speed were measured under different operating conditions (vibration-free operation, low vibration operation and maximum vibration operation). The measurements made showed that the operation of the roller with the use of vibration does not damage the structure, which can lead to the destruction of the building. The effect of vibration on the occurrence of cracks is possible, but there are additional factors that affect the occurrence of cracks. After the complaints received, all compaction operations were suspended and on the basis of recommendations specified in the report, it was decided to produce a compaction without vibration.

Issue 9: Cholponov, a resident of Petrovka, Centralnaya St., 293. Cracks in the house, will compensation be paid?

Response:
After studying the issue of level and speed of vibration, it was decided to continue to work without vibration, by increasing the number of passes of road rollers. Before the start of work on the site in the village of Petrovka in 2017, the Contractor performed a visual inspection and registering of the existing cracks, in each act there is a signature of the owner of the house or his close relative,

confirming that the visual inspection has been carried out and everything is fixed. According to available information, the fixed cracks and specified cracks in the complaints were previously present. In any case, each complaint is individual and each case will be considered individually with each applicant. No compensation is provided for. If during the inspection of the application the fault of the Contractor is proved, the Contractor himself will conduct negotiations with the applicant and resolve this issue individually.

<u>Issue 10</u>*: on the expansion of the road from Lenin Street to Kalinin Street (the central street from the side of the bazaar, the Bishkek-Osh road section). There is traffic jam.*

Response:
The project for the reconstruction of the Bishkek-Kara-Balta road section is classified as a 1st category (4 lanes) with the arrangement of roadsides, parking lots, new sidewalks, drainage trays, new pedestrian crossings with the installation of traffic lights. The width of the roadway will be 28 meters (3.5 m. Four lanes-two lanes in both directions). In this section, the standard applied in urban conditions will be used and the roadside will be narrowed. After the completion of reconstruction, the driving path will be more spacious, but the traffic jams that are arising at the moment are created by drivers who park without observing the rules.

<u>Issue 11</u>*: Yusupov A. on the video on TV (channel NTS) of the citizen Shabohodzhoeva T. regarding information on the amount of compensation. You must protect us from journalists.*

Response:
We saw this video shown on the NTS channel, and citizen Shabohodzheyeva T. answered the question asked by journalists on the amount of compensation received by her and disclosed the received amount. We believe that the citizen Shabohodzhoeva T. is responsible for the information provided. From our side, we cannot protect citizens from communication with media representatives. We understand that the amount of compensation paid to persons affected by the project is confidential and this information is not given from our side. An exception is an official request from the internal affairs agencies, the Accounting Chamber, the financial police during carrying out inspections.

<u>Issue 12</u>*: Petrovka village– underground water, tree cutting, damage of communication lines and lack of Internet.*

Response:
On underground water. From the Contractor's side, the drainage pipes are being constructed which will be connected to new concrete trays, which in turn will be connected to existing drainage channels. Clearing of the drainage channels located far from the project road will not be done, it is the responsibility of the local government bodies within the framework of the Law of the Kyrgyz Republic "On Civil Protection".
On tree cutting. Tree cutting on the Section 1.3 was completed in 2017. In the current year, work will begin to set out the center and the road cross section in the remaining areas, after which work will begin on marking the trees falling under the cutting. The Contractor will receive the appropriate permission to cut trees and after the receipt of approval from ADB, the work on cutting down the trees will be started. All the cut down trees are transferred to the local government by the Contractor. Within the framework of the current project, compensatory measures are envisaged in the part of planting new trees at suitable sites along the road at the rate of 1: 3.
On the damaged communication lines. Yes, there was such a fact, at the beginning of work on the relocation of communication lines in the village of Petrovka, some communication lines were damaged, but they were eliminated together with Kyrgyztelecom. In order to prevent such facts, joint meetings (Consultant, Contractor, Kyrgyztelecom) were conducted and coordinates were exchanged and it was decided to re-conduct the survey for the prompt resolution of these issues.

<u>Issue 13</u>*: Yusupov A. – why permission is not given for construction on the own land after the demolition of the object affected by the project.*

Response:
the representative of the State Ecological Inspectorate of the Moscovsky District explained that in accordance with the Regulation of the Government, a moratorium was imposed on the issuance and approval of permits for the construction of facilities located 32 m from the road axis before the end of the project, that this requirement does not apply to objects located beyond 32 m. In your case, hairdressing salon must be constructed in accordance with the requirements specified in the Order and the requirements of the regional architecture.

<u>Issue 14</u>: Asphalting of secondary roads.

Response:
The Contractor has started to carry out the work on the use of old asphalt for the filling of on-site roads. Contractor will repeatedly send the request to the District Administration and ayil okmotu to specify the list of streets to which the old asphalt will be removed to improve the condition of the on-site roads. Asphalting of the off-ramps and junctions of the central roads with the reconstructed road at the distance from 5 to 15 meters will be carried out.

Minutes of
the holding of public hearings
on the construction of Bishkek-Kara-Balta road section project

June 08, 2018 Novo-Nikolaevka village

Venue: Club of Novo-Nikolaevka village, 14.00

Participants:

Alymbaev N.	- First Deputy Head of Jaiyl rayon state administration
From IPIG MOTR:	
Aliev M.B.	- Specialist on land issues and architecture of the IPIG under the MOTR KR;
Kartanbaeva N.	- Safeguard measures specialist / sociologist IPIG under the MOTR KR;
from EPTISA:	
Toktomambetov A.D.	- Deputy Team Leader;
Dolgov Yu.Yu.	- Resettlement specialist;

43 people - invited residents of Sokuluk district and representatives of organizations

Agenda:
Information on the construction project of the Bishkek-Kara-Balta road section, in particular, the modification of the method for compaction of the road embankment without using vibration.

Issues and discussions:

Introductory speech:
Information on the project was presented by Aliev M. Information was provided on the construction project of the Bishkek-Kara-Balta road section and the ongoing work under the current project. An explanation was given regarding the activities carried out in the scope of studying vibration impact after complaints received in 2017. Explanation was given regarding works which were carried out to study the issue of vibration (necessary studies) with the involvement of local specialists (Institute of Seismology of the National Academy of Sciences of Kyrgyzstan, State Institute of Antiseismic Construction and Engineering Design under the Government), as well as an international specialist hired by the consulting company EPTISA.

<u>Issue 1</u>: width of the roadway

Response:
The project for the reconstruction of the Bishkek-Kara-Balta road section is classified as a 1st category (4 lanes) with the arrangement of roadsides, parking lots, new sidewalks, drainage trays, new pedestrian crossings with the installation of traffic lights, construction of new underground transitions (mainly at school locations) and rehabilitation of old ones. The width of the roadway will be 28 meters (3.5 m. Four lanes-two lanes in both directions). In addition, divider barriers "Jersey" will be installed.

<u>Issue 2</u>: Demolition of the gas filling station. It is necessary to demolish the "KNK" gas filling station and to expand in this direction (towards the gas filling station site).

Response:
Demolition of the gas filling station "KNK" is not provisioned, the road rehabilitation project provides for the maximum use of the existing road section and a slight expansion. The gas station does not obstruct the projected road.

<u>Issue 3</u>: location of the underground passage. The planned underground pedestrian crossing is next to the house and after construction will disturb residents.

Response:
Within the framework of the current project, it is planned to repair the existing underground pedestrian crossings and to construct a new underground pedestrian crossing at the site of the school in Novonikolaevka village. Moreover, divider barriers "Jersey" will be installed in order to exclude crossing into oncoming traffic and additional traffic lights will be installed at the junction points of the central streets to the Bishkek-Osh road. These measures are aimed at improving the safety of people, including pedestrians. Underground pedestrian crossing will be shifted towards the school closer to the Sovetskaya street for the convenience of residents, the necessary instructions will be given to the Consultant and the Contractor.

<u>Issue 4</u>: The road and sidewalks are passing close to houses and land

Response:
Land plots are not affected by the project. The road is broadened in both directions, symmetrically. The sidewalks on both sides will be located practically in the same places as the existing ones, with a widening of up to 3 m. The distance from the edge of the road to the construction line from the north side is 11-20 m.

ANNEX 2
2017 Baseline Air, Noise and Water Quality Monitoring At Predefined Stations

And Comparison with Sampling Data For 2013 And 2015

BASELINE MONITORING UPDATE SUMMARY

In May 2017 a set of samples were collection and analyzed for air, noise and surface water quality at a set of stations sampled in 2013 and 2015. This was a requirement of the ADB and to that end graphs and data tables of these (2013, 2015 and 2017) results are presented in this annex to the 2015 IEE.

- Air Quality

The following four parameters were monitored in 2013, 2015 and 2017. Samples were collected at all locations in 2015 and 17 but only at 13 of the 16 stations sampled in 2017. For the 13 stations samples were taken at the same locations and approximately at the same time. A listing of all numerical data collected is presented in Table 32.

III. Carbon Monoxide (CO)

Carbon monoxide levels as measured in 2013 exceeded maximum permissible concentrations (MPC) at six of 16 stations, whereas in 2015 (the year EPTISA began monitoring) only the Poltavka School station had a CO concentration of 13 mg/m^3 with a variation of only 0.25 mg/m^3. The MPC for CO is 5 mg/m^3 , signalling a serious exceedances, especially at a school (Figure 11). IPIG was made aware of this reading in the IEE. However, 2017 measurements at the same locations and at approximately the same times, resulted in quite different results. All 16 stations had readings well below the 5 mg/m^3 MPC.

Since the only source of CO is from vehicle exhausts and given that that the sensitive receptor >30m from the EOP is most likely that the ready is an anomaly or sampling error, given that the sampling method involves collection in plastic bladder, transport to a lab and then analysis. All of 2017 sample collection was supervised in the field by EPTISA, and none exceeded the MPC level.

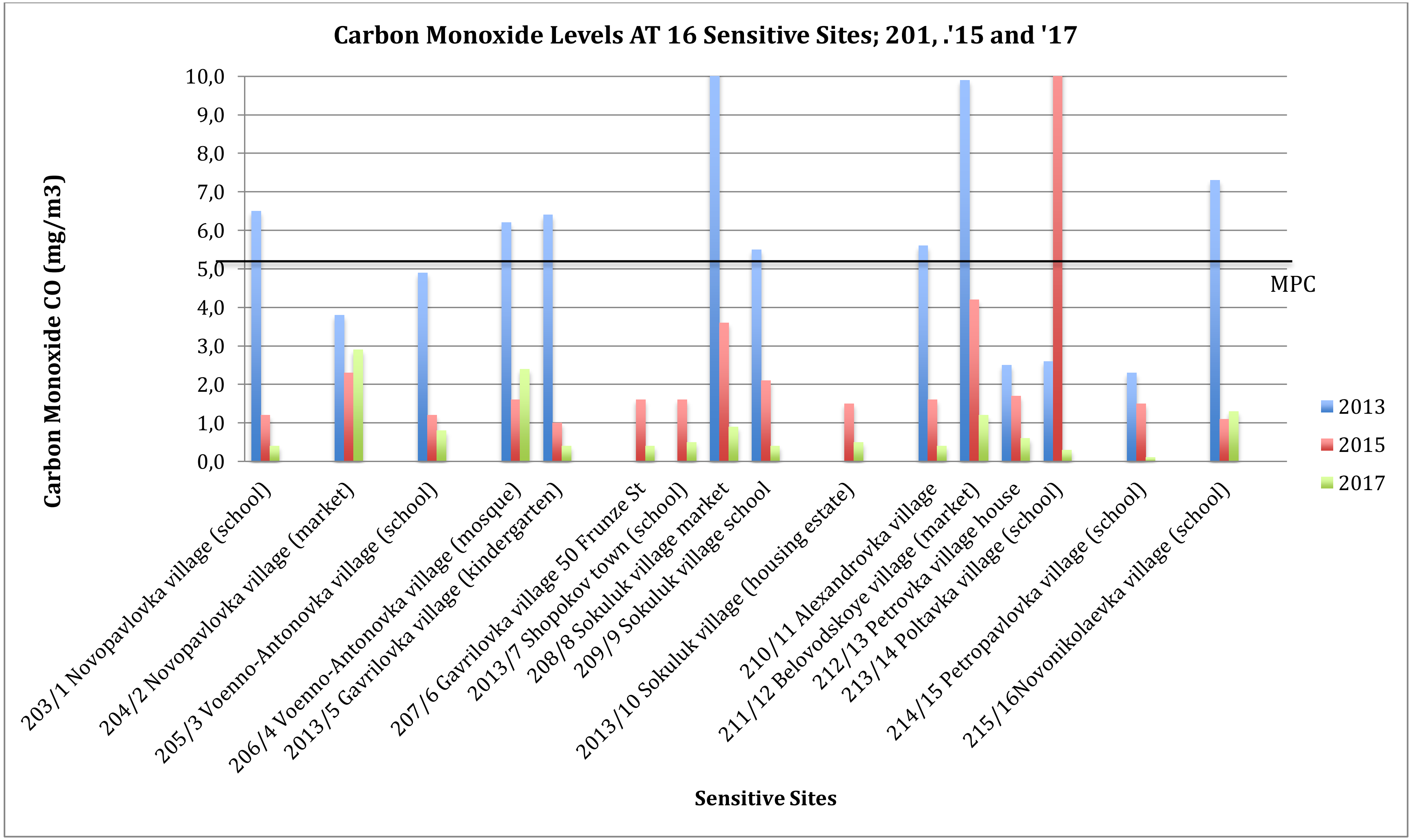


Figure 11 Carbon Monoxide Monitoring Results 2013, '15 and '17

IV. Nitrogen Dioxide (NO_2)

NO2 is a by product of the combustion of petrol from vehicles and any internal combustion engine. Therefor roadside level are generally at or exceeding the MPC levels for Kyrgyzstan which is 0.085 mg/m3 .The 2013 levels were all recorded as < 0.01 mg/m3. The 2015 results showed that none of stations had levels exceeding the MPC.

For 2017 seven of the 16 stations had NO2 levels exceeding the MPC (Figure 12), with the Novopavlovka Village market recording a 0.30 mg/m3 reading. The market sees a great deal of slow moving traffic transporting goods to and from the market and therefore higher NO2 level would not be unusual.

Further there was a direct correlation between distance fronm the EOP and NO_2 levels (

Table 34).

V. Sulphur Dioxide (SO_2)

For 2013 SO2 levels exceeded the MPC level at all 13 stations, while for 2015 and 2017 levels were all below 0.005 mg/m^3 (Figure 13). This very large variation suggests sampling or analytical errors. .Construction period monitoring over a longer time period should provide a better indication of local SO2 concentrations.

VI. Total Suspended particulate Matter (TSP)

TSP levels during the three sampling years varied enormously, with the most consistent being 2015 where all but the Voenno-Antonovka Village mosque site exceeded the MPC level of 0.5 mg/m^3. These data suggest that background levels of TSP exceed Kyrgyz MPC and that dust control will be an important construction period mitigation measure.

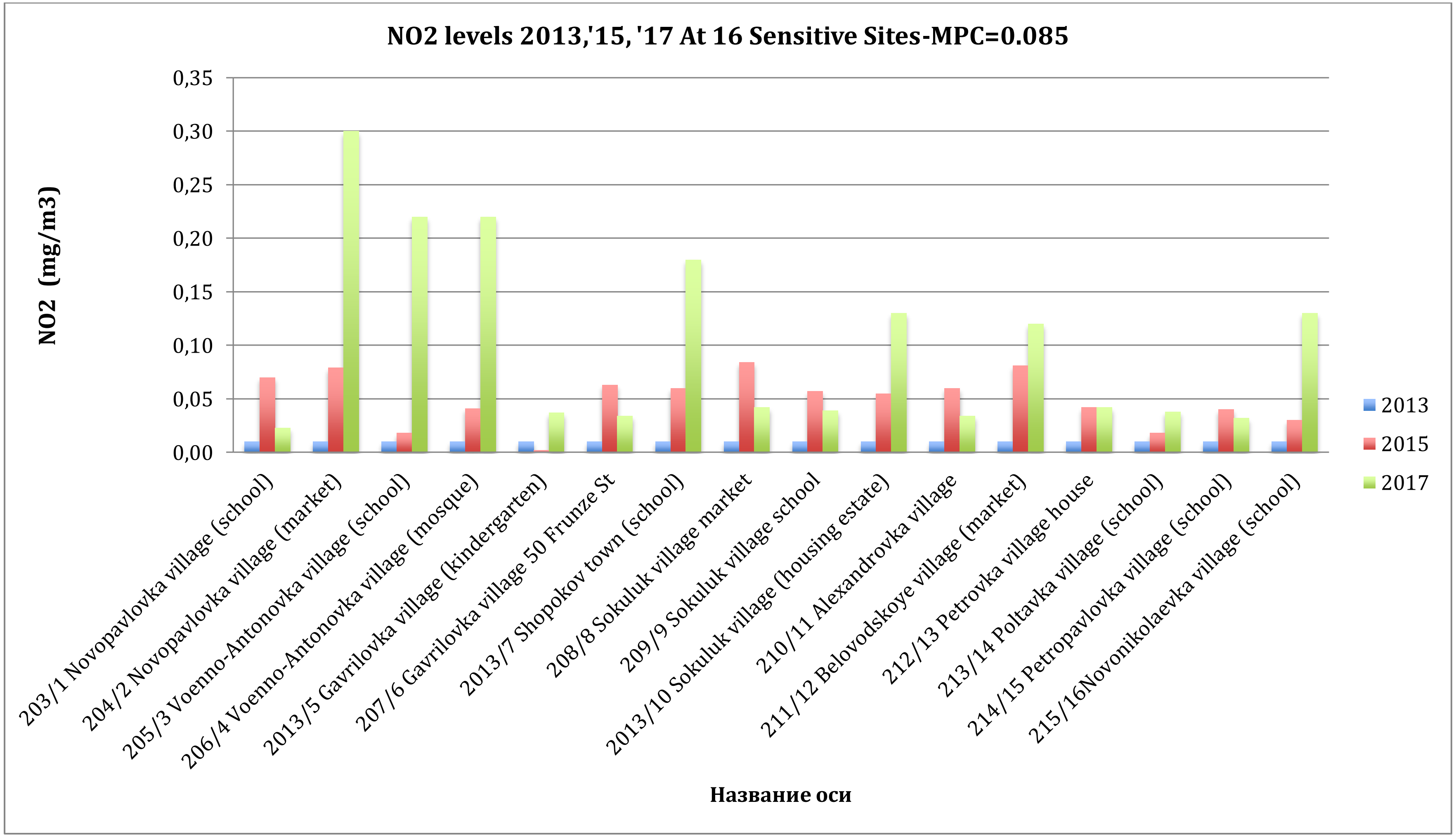


Figure 12. NO_2 measurements at 16 stations 2013, '15 and '17

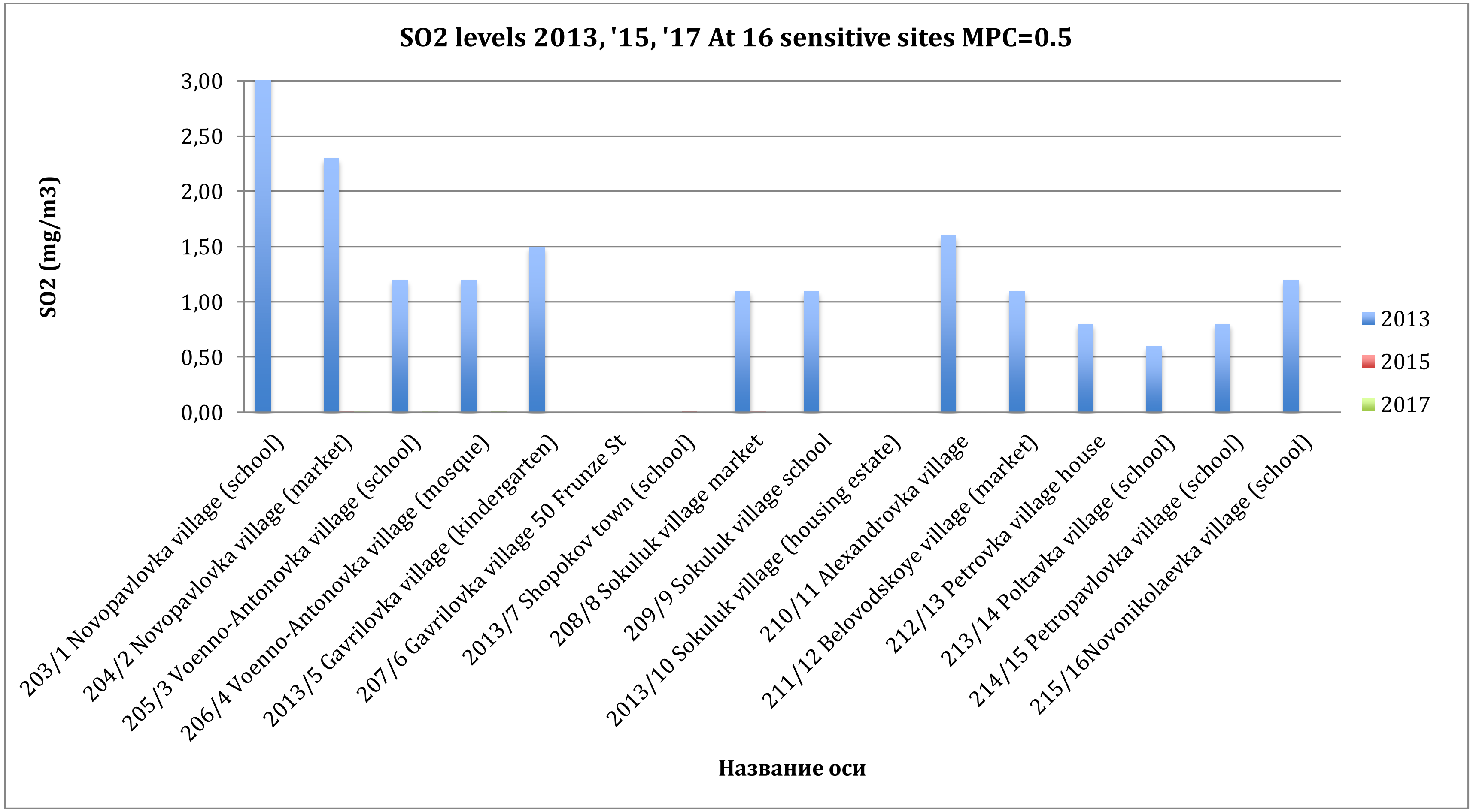


Figure 13. SO2 levels at 16 stations, 2013, 2015 and 2017. 2015 and ’17 results all < 0,005 mg/m^3 not shown on graph

Table 34. Air quality data for 18 sensitive receptors along the Bishkek-Kara Balta Road

Station Number	Location**			CO			NO2			SO2			TSP		
	Name	Dist. From EOP (m)	Chainage From Bishkek (km)	2013	2015	2017	2013	2015	2017	2013	2015	2017	2013	2015	2017
1	Novopavlovka village (school)	33	9.9	6.5± 1.6	1.2± 0.24	0,4±0,08	<0.01	0.070 2017 0.018	0,023± 0,0058	3.2± 0.8	0.004± 0.001	0,004± 0,001	<0.1	1.6± 0.4	0,4±0,1
2	Novopavlovka village (market)		11.0	3.8± 0.95	2.3± 0.46	2,9±0,58	<0.01	0.079± 0.020	0,3± 0,075	2.3± 0.6	0.007±± 0.0018	0,009± 0,0023	<0.1	2.2± 0.6	0,5±0,13
3	Voenno-Antonovka village (school)	50	12.86	4.9± 1.2	1.2± 0.24	0,8±0,16	<0.01	0.018± 0.0045	0,22± 0,055	1.2± 0.3	0.002± 0.0005	0,007± 0,0018	<0.1	2.3± 0.6	0,5±0,13
4	Voenno-Antonovka village (mosque)	10	14.2	6.2± 1.6	1.6± 0.32	2,4±0,48	<0.01	0.041± 0.010	0,22± 0,055	1.2± 0.3	0.002± 0.0005	0,006 ±0,001 5	<0.1	0.24± 0.6	0,7±0,18
5	Gavrilovka village (kindergarten)	30	21.5	6.4± 1.6	1.0± 0.2	0,4±0,08	<0.01	0.002± 0.0005	0,037± 0,009	1.5± 0.4	0.002± 0.0005	0,003± 0,0008	<0.1	2.8± 0.7	0,8±0,2
6	Gavrilovka village (dwelling house, 50, Frunze street)	20	20.95		1.6± 0.32	0,4±0,08 0		0.063± 0.016	0,034± 0,0085		0.003± 0.0008	0,003± 0,0008		3.5± 0.9	0,5±0,13
7	Shopokov town (school)	20	22.33		1.6± 0.32	0,5±0,1		0.060± 0.015	0,18±0 ,045		0.006± 0.0015	0,004± 0,001		1.6± 0.4	0,5±0,13
8	Sokuluk village (market)	10	27.15	10.4± 2.6	3.6± 0.72	0,9±0,18	<0.01	0.084± 0.021	0,042± 0,011	1.1± 0.3	0.009± 0.002	0,003± 0,0008	<0.1	2.0± 0.5	0,15± 0,038
9	Sokuluk village (school)	15	27.5	5.5± 1.4	2.1± 0.42	0,4±0,08	<0.01	0.057± 0.014	0,039± 0,01	1.1± 0.3	0.004± 0.001	0,004± 0,001	<0.1	2.0± 0.5	0,4±0,1
10	Sokuluk village (housing estate)	10	25.6		1.5± 0.3	0,5±0,1		0.055± 0.014	0,13± 0,033		0.003± 0.0008	0,004± 0,001		1.8± 0.5	0,3± 0,075
11	Alexandrovka village	80	30.5	5.6± 1.4	1.6± 0.32	0,4±0,08	<0.01	0.060± 0.015	0,034± 0,0085	1.6± 0.4	0.003± 0.0008	0,003± 0,0008	<0.1	1.8±0. 5	0,4±0,1
12	Belovodskoye village (market)	10	43.0	9.9± 2.5	4.2± 0.84	1,2±0,24	<0.01	0.081± 0.020	0,12±0 ,03	1.1± 0.3	0.003± 0.0008	0,004± 0,001	<0.1	0.8± 0.2	0,3±0,07 5
13	Petrovka village (dwelling house)	10	51.0	2.5± 0.6	1.7± 0.34	0,6±0,12	<0.01	0.042± 0.011	0,042± 0,01	0.8± 0.2	0.002± 0.0005	0,003± 0,0008	<0.1	1.2± 0.3	0,9±0,23

Station Number	Location**			CO			NO2			SO2			TSP		
	Name	Dist. From EOP (m)	Chainage From Bishkek (km)	2013	2015	2017	2013	2015	2017	2013	2015	2017	2013	2015	2017
14	Poltavka village (school)	30	55.0	2.6± 0.7	13± 0.26	0,3±0,06	<0.01	0.018± 0.005	*0,038± 0,01*	*0.6± 0.2*	0.001± 0.0003	0,004± 0,001	<0.1	1.6± 0.4	1,00,25
15	Petropavlovka village (school)		57.1	2.3± 0.6	1.5± 0.3	0,1±0,02	<0.01	0.040± 0.01	*0,032± 0,008*	*0.8± 0.2*	±0.003	0,003± 0,0008	<0.1	1.3± 0.3	0,3±0,075
16	Novonikolaevka village (school)		59.53	*7.3± 1.8*	1.1± 0.22	1,3±0,26	<0.01	0.030± 0.008	*0,13±0,033*	*1.2± 0.3*	0.002± 0.0005	0,003± 0,0008	<0.1	1.4±0.4	0,7±0,18
Standard (MPC)				**5**	**5**		**0.085**	**0.085**		**0.5**	**0.5**		**0.5**	**0.5**	

B. Noise

Noise was measured at 18 sensitive receptor sites along the road alignment. Measurements were taken during the day (0800-1100) and in the early evening between 1700-1900.

The road alignments with traffic volumes exceeding 22,000 vehicles per day in some sections of the road, is classified as a commercial zone and as such permissible noise levels are70 dBA during the day and 60 dBA at night.

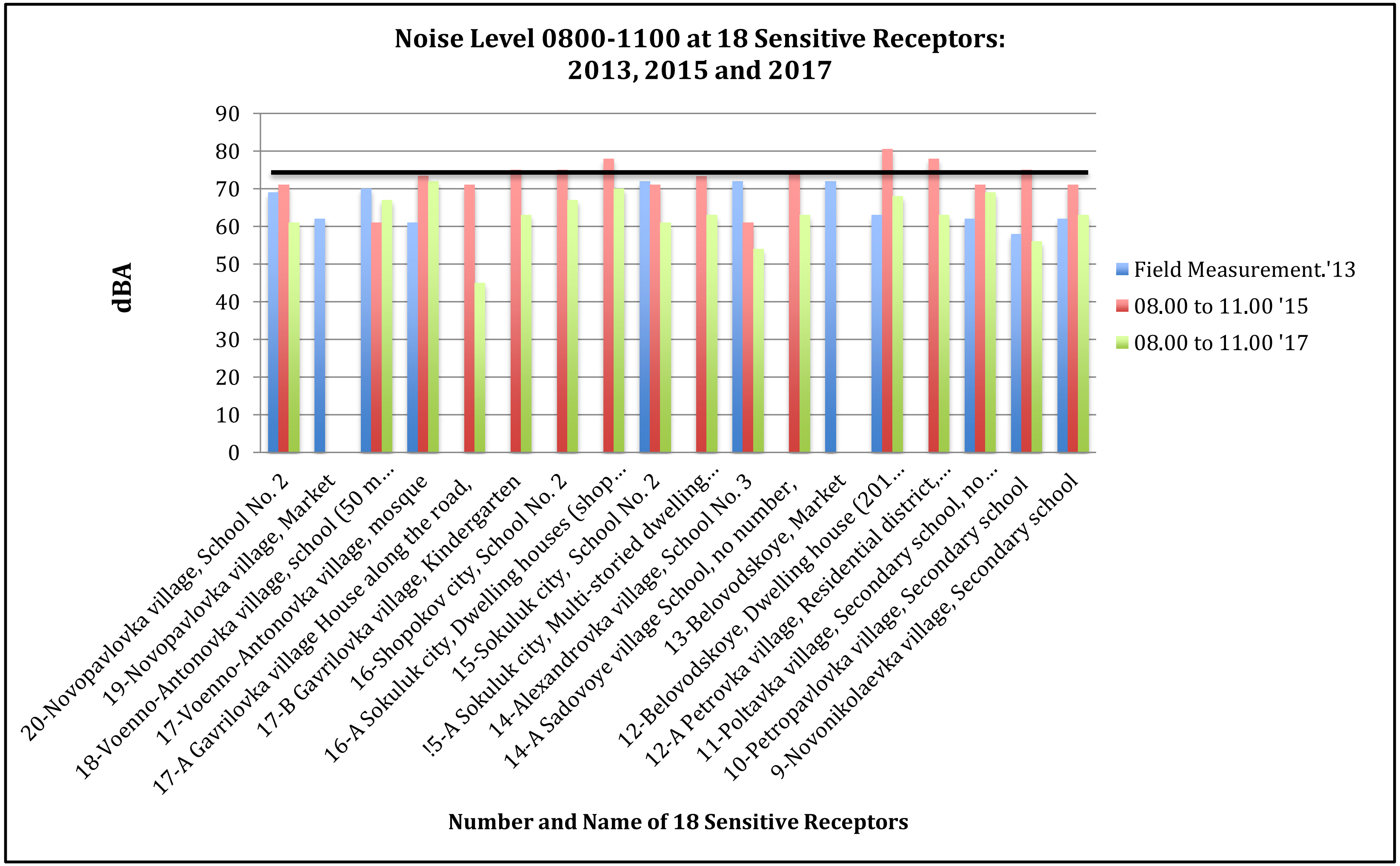
VII. Noise Between 0800 and 1100 Hours

For 2013 four of the 13 measurements taken exceeded the MPC level. In 2015, 14 of the 18 stations had noise readings at or above 70 dBA. In 2017 all but the Voenno-Antonovka Village mosque and Sokuluk city dwelling (16) sites had levels below 70 dBA. Given the level of traffic and large percentage of trucks and buses the noise levels will be high and more likely reflect the 2015 survey dataset (Figure 14).

VIII. Noise Between 1700 and 1900 Hours

For all three years of sampling only the 2013 Petropavlovka Secondary School site measurement had a noise level below the 60 dBA MPC for night time in a commercial zone. Existing night-time noise levels along this roadway are excessive and almost all exceed MPC, reflecting the very high traffic volume stretching into the evening until 2100.

Figure 14. Noise levels between 0800 and 1100 at 18 sensitive receptors for 2013, ’15 and ’17.



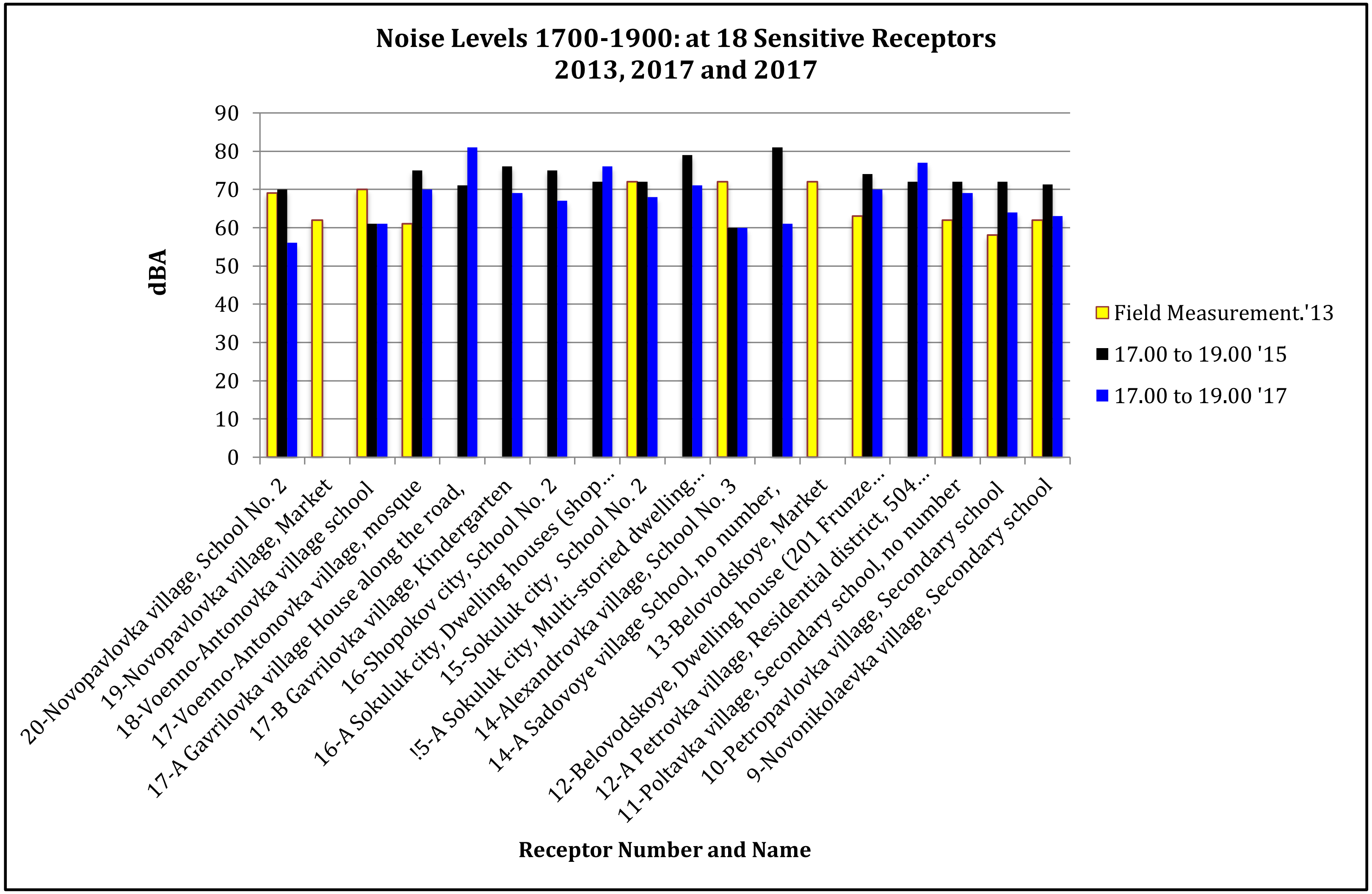


Figure 15. Noise levels between 1700 and 1900 at 18 sensitive receptors for 2013, ’15 and ’17.

Table 35.Noise dataset 1013, 2015 and 2017

Noise sensitive sections: Sampling Station No. used on 2013 survey and again in 2015 and 2017		Km from Bishkek	Distance from carriage-way to receptor (m)	Measured Noise level, Leq dBA.							
				2013	2015			2017			Day
No.				Field Measurement	Aver-age	08.00 to 11.00	17.00 to 19.00	Aver-age	08.00 to 11.00	17.00 to 19.00	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							**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**
4	Gavrilovka village House along the road,	20.8	30		71	71	71	63	45	81	**55**
5	Gavrilovka village, Kindergarten	21.5	20		75.5	75	76	66	63	69	**55**
6	Shopokov city, School No. 2	22.330	20		75	75	75	67	67	67	**55**
7	Sokuluk city, Dwelling houses (shop “Tatyana”)	27.150	10		75	78	72	73	70	76	**55**
8	Sokuluk city, School No. 2	27.5	15	72	71.5	71	72	64.5	61	68	**55**
9	Sokuluk city, Multi-storied dwelling buildings	25.6	10		76.15	73.3	79	67	63	71	**55**
10	Alexandrovka village, School No. 3	30.5	80	72	60.5	61	60	57	54	60	**55**

Noise sensitive sections: Sampling Station No. used on 2013 survey and again in 2015 and 2017 No.		Km from Bishkek	Distance from carriage-way to receptor (m)	Measured Noise level, Leq dBA.							Day
				2013	2015			2017			
				Field Measurement	Aver-age	08.00 to 11.00	17.00 to 19.00	Aver-age	08.00 to 11.00	17.00 to 19.00	MPL (Leq)
11	Sadovoye village School, no number,	37.4	10		77.75	74.5	81	62	63	61	**55**
12	Belovodskoye, Market	43.0	1	72							**55**
12A	Belovodskoye, Dwelling house (201 Frunze St.)	42.45	10	63	77.25	80.5	74	69	68	70	**55**
13	Petrovka village, Residential district, 504 Tsentralnaya St	51	8		75	78	72	70	63	77	**55**
14	Poltavka village, Secondary school, no number	55	30	62	71.5	71	72	69	69	69	**55**
15	Petropavlovka village, Secondary school	57.1	8	58	73.5	75	72	60	56	64	**55**
16	Novonikolaevka village, Secondary school	59.550	22	62	71.15	71	71.3	63	63	63	**55**

Note; MPL refers to maximum permitted level, but the unit is Leq—as Leq

C. Surface Water Quality

Surface water quality was tested at 6 sites along the project alignment during 2015 and 2017 (Table 36). These locations were all at sites were the road crossed a water body. Since three of the six streams crossed are highly intermittent, with no flows for many months, limited data were collected from Krepostnoy Crossing, Zhantay Canal (Vostochnaya St.) and the Zhalamysh River.

I. pH

pH, a measure of a waters acidity indicated slightly acidic waters at all locations ranging between 7.9 and 8.5. These levels are within the KR's MPC (Figure 16).

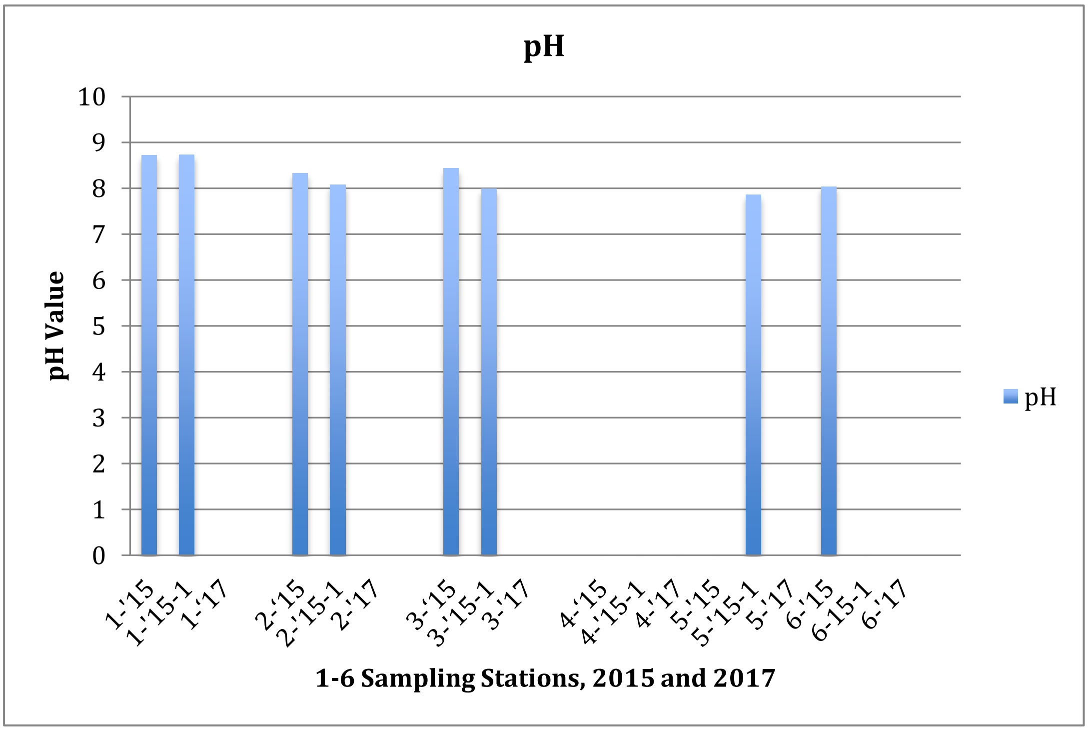


Figure 16. pH readings at six sampling stations in 2015 and 2017

II. Biochemical Oxygen Demand (BOD5)

KR MPC for BOD5 suggests that values up to 85 mg O_2/L are acceptable for general purpose water. BOD 5 levels recorded for the 2017 and 2017 sampling period had very low levels, never exceeding 3.55 mg/L. Based on the results, background BOD5 levels are not an issue (Figure 17).

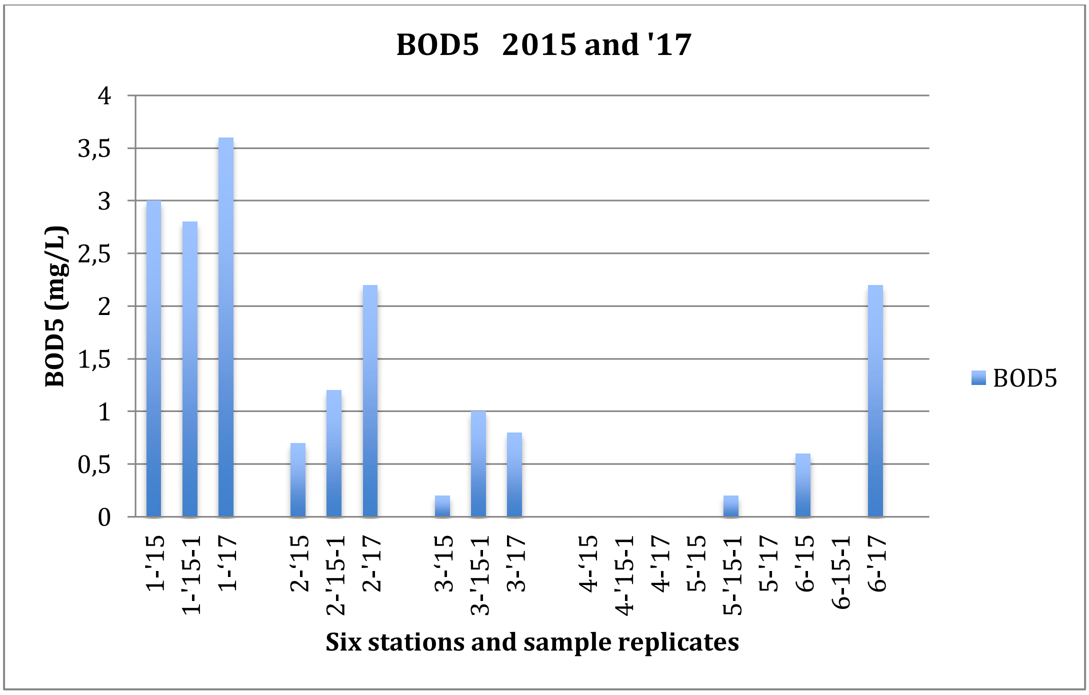


Figure 17. BOD5 readings at six sampling stations in 2015 and 2017

III. Conductivity

Depending on the surrounding geology conductivity levels can vary greatly and not raise any alarm vis-à-vis general use. Values between 15 and 1500 are acceptable, although higher values my impart taste or excessive hardness of the water. During the 2015 and 2017 sampling years conductivity levels ranged between 214 and 564 um/cm, well within the normal background range for waters downstream of a large mountain range.

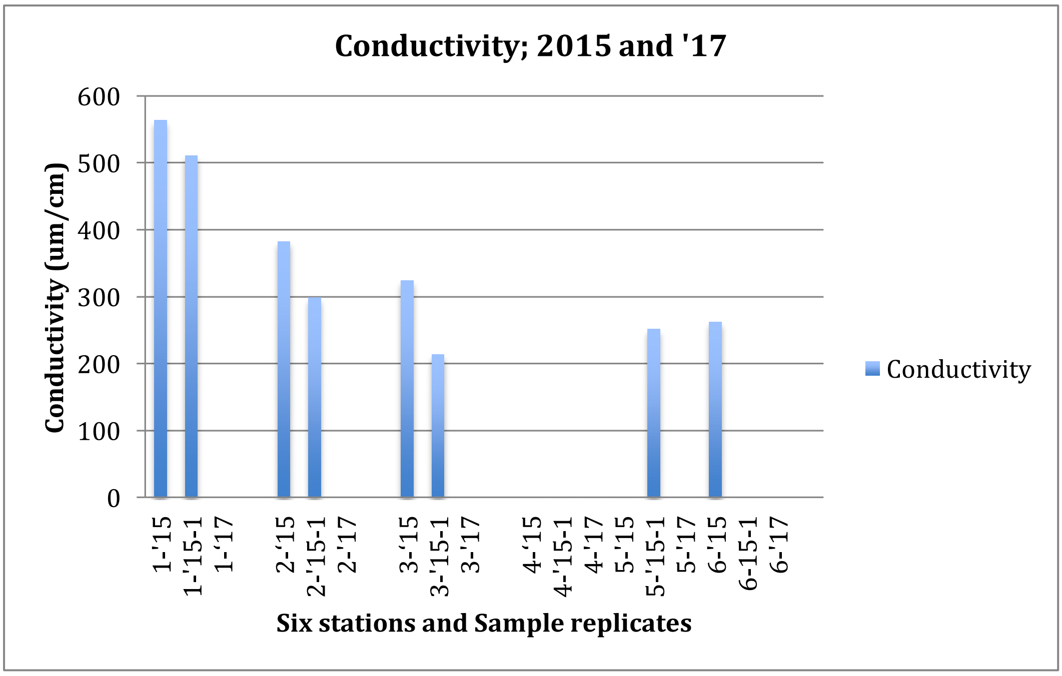


Figure 18. Conductivity at six stations measured in 2015 and 2017

IV. Oil and Grease

Oil and grease comes from runoff close to vehicles or in areas were vehicles are parked and leak oil and fuel.   Filling stations without proper spill controls also are the source of oil and grease in surface water. Of all the samples taken only 11 had any trace of oil and grease and these levels were far below the KR MPC of 0.3 mg/L (general use), but did exceed fisheries use levels by 0.2 to 0.3 mg/L at three stations (Figure 19).
Oil and grease may become an issued during construction as a large fleet of vehicles and equipment will be constantly travelling the project alignment. For this reason, the continued measurement of this parameter will be very useful.

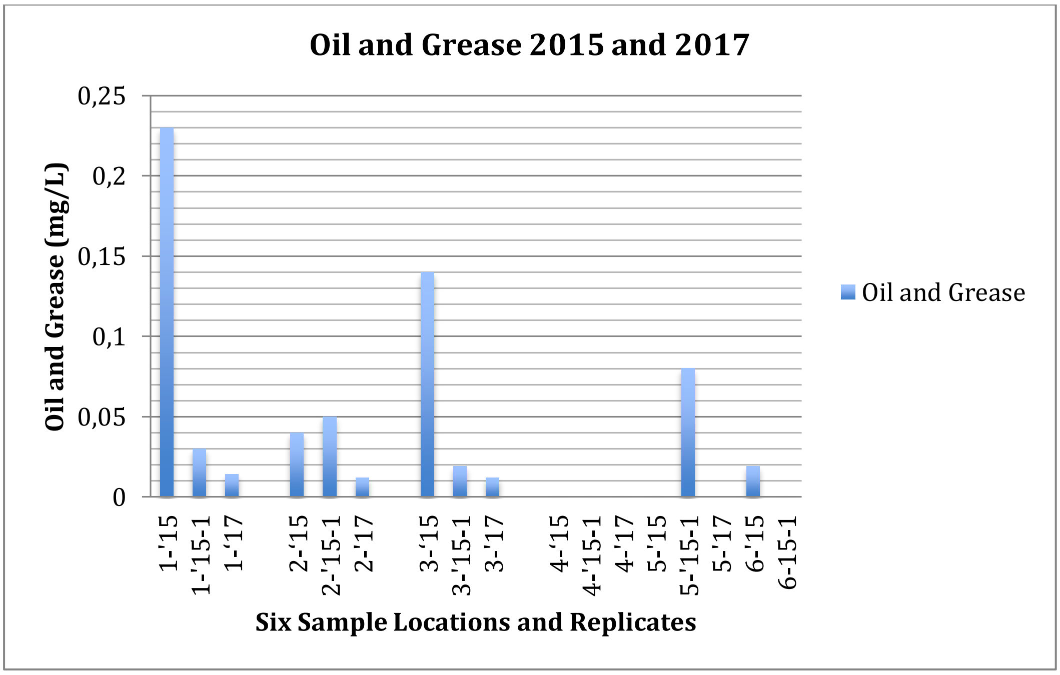


Figure 19. Oil and grease concentrations at six locations 2015 and 2017

V. Heavy Metals: Zinc, Copper, Cadmium

These three parameters were tested at all sites during 2015 and 2017 and all values were well within KR MPC, most at the instrument detection limits or around 0.01 mg/L. These parameters will continue to be monitoring since the 2015 and 2017 values appear to exhibit sampling or testing errors.

VI. Water Transparency

Water transparency measures the light penetration depth in relation to a disk lowered into the water column . the few values collected suggest poor transparency . However since there were only three data points sampling for this parameter will continue in order to establish a better dataset (Figure 20).

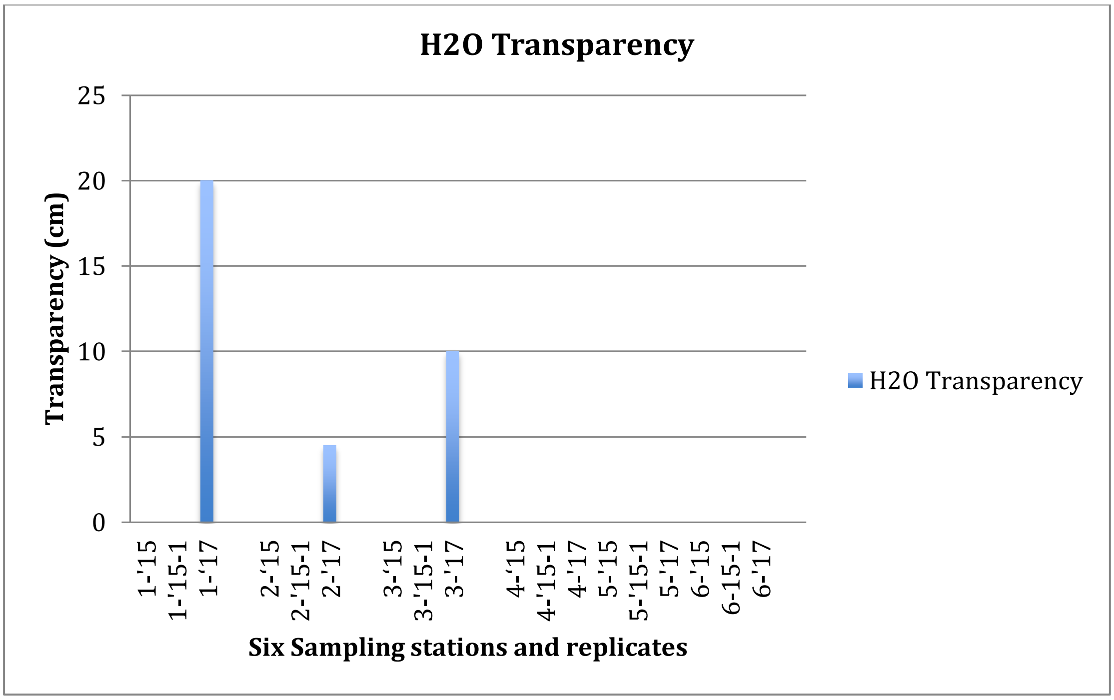


Figure 20. Water Transparency at three locations 2017

Table 36 Surface water quality data set 2015 NS 2017 at six stations along the road alignment.

Sampling location	St. No No/Yr./Rep	Date and time of sampling	Weather conditions	Coordinates	pH	BOD 5, mg /l	Conduc-tivity, (µs/cm)	Suspended solids, mg/l	Oil and grease, mg/l	Copper, mg/l	Zinc, mg/l	Cadmium, mg/l	Transparency, cm
Orto-Suu village, km.55, pond 2015	1-'15	28.04.2015 10.50	sunny	N $42^{0}\ 42^{/}\ 27{,}5^{//}$ E 0,75 $^{0}50^{/}\ 29.8^{//}$	8.72	3.0	564	6.4	0.23	<0.0006	<0.0005	<0.0002	
Orto-Suu village, km.55, pond 2015	1-'15-1	22.05.2015 09.40	sunny	same	8.73	2.8	511	10.6	0.03	<0.0006	<0.0005	<0.0002	
Orto-Suu village, km.55, pond 2017	1-‘17	27.04. 2017 10.50	sunny	same		3.6		12.8	0.014				20
Ak-Suu river* in front of a bridge, km.43+500 - ‘15	2-‘15	28.04.2015 11.15	sunny	N $42^{0}\ 49^{/}\ 49{,}3^{//}$ E 0,74 $^{0}04^{/}\ 55{,}1^{//}$	8.32	0.7	383	52.8	0.04	<0.0006	<0.0005	<0.0002	
22.05.15	2-'15-1	22.05.2015 09.57	sunny	same	8.07	1.2	299	1178.0	0.05	<0.0006	<0.0005	<0.0002	
27 04-17	2-'17	27.04. 2017 11.25	sunny	Same		2.2		236.0	<0.013				4.5
Sokuluk river** in front of a bridge Km.????	3-‘15	28.04.2015 12.05	sunny	N $42^{0}\ 51^{/}\ 22{,}3^{//}$ E 0,74 $^{0}16^{/}\ 36{,}2^{//}$	8.43	0.2	325	9.0	0.14	<0.0006	<0.0005	<0.0002	
	3-'15-1	22.05.2015 10.44	sunny	Same	7.98	1.0	214	256.8	<0.02	<0.0006	<0.0005	<0.0002	

Sampling location	**St. No No/Yr./Rep**	**Date and time of sampling**	**Weather conditions**	**Coordinates**	**pH**	**BOD 5, mg /l**	**Conduc-tivity, (μs/cm)**	**Suspended solids, mg/l**	**Oil and grease, mg/l**	**Copper, mg/l**	**Zinc, mg/l**	**Cadmium, mg/l**	**Transparency, cm**
	3-'17	27.04. 2017 11.55	sunny	Same		0.8		59.2	<0.013				10
"Krepostnoy" narrow bridge at km.27+150	4-'15	28.04.2015	dry bed	N 42^0 50$'$ 02,0$''$ E 0,74 ^{0}07$'$ 20,2$''$	-	-	-	-	-	-	-	-	
	4-'15-1	22.05.2015	dry bed	same	-	-	-	-	--	-	-	-	-
	4-17	27.04. 2017	Dry bed		-	-	-	-	-	-	-	-	-
"Zhantay"canal ** Vostochnaya street km. 24+110	5-'15	28.04.2015	dry bed	N 42^0 51$'$ 52,6$''$ E 0,74 ^{0}20$'$ 08,9$''$	-	-	-	-	-	-	-	-	
	5-'15-1	22.05.2015 10.55	sunny	same	7.85	0.2	252	3859.2	0.08	<0.0006	<0.0005	<0.0002	
	5-'17	27.04. 2017	dry bed										
Zhalamysh river * bridge at km.17+850	6-'15	22.05.2015 11.06	sunny	N 42^0 52$'$ 10,7$''$ E 0,74 ^{0}23$'$ 18,1$''$	8.03	0.6	263	809.2	<0.02	<0.0006	<0.0005	<0.0002	
	6-15-1	28.04.2015	dry bed	Same	-	-	-	-	-	-	-	-	
	6-17	27.04. 2017 13.05	sunny	Same		2.2		268.6	0.020				0.0
*** MPC for fishery water ponds category**					**6.5-8.5**	**3**			**0.05**	**0.001**	**0.01**	**0.005**	

Sampling location	St. No No/Yr./Rep	Date and time of sampling	Weather conditions	Coordinates	pH	BOD 5, mg /l	Conduc-tivity, (µs/cm)	Suspended solids, mg/l	Oil and grease, mg/l	Copper, mg/l	Zinc, mg/l	Cadmium, mg/l	Transparency, cm
**** MPC for general use category**					**6.5-8.5**	**3**			**0.3**	**1**	**1**	**0.001**	
Applicable Normative legal acts complied with					ERC p.1 M. 1977	MP 2-85	ERC p.1 M. 1977	ERC p.1 M. 1977	ERD F 14.1:2:4.128-98	MI 08-47/091	MI 08-47/091	MI 08-47/091	

E. Conclusion

Background levels of noise and concentrations for 4 air quality parameters consistently exceeded KR's MPC and will need to carefully monitored during the construction period. These requirements were already defined in the IEE, its EMP and update in the Construction Environmental Management Workplan (CEMWP).

It is likely that construction will contribute only marginally to these values but to confirm this, monitoring is continuing on monthly bases for all parameters. As well, special noise modelling and vibration impact studies have been completed (March and March 2018 respectively) as summarized in the IEE.

Annex 2A.
Vibration Study

VIBRATION ASSESSMENT.

BISHKEK-OSH ROAD IMPROVEMENT PROJECT

REHABILITATION AND UPGRADING OF BISHKEK-KARA-BALTA SECTION, KM 15.9-KM 61

EPTISA SA

FINAL REPORT

FEBRUARY 2018

CONTENTS

1. INTRODUCTION

Construction work on the rehabilitation and upgrading of Bishkek-Osh Road in Kyrgyzstan (Bishkek-Kara-Balta Section, km 15.9-km 61) started in May 2017 and remains to be completed. However residents in the houses alongside the route are concerned about risk of cosmetic or structural damage to their homes as a result of construction vibration, including the use of vibrating rollers for compaction of the road sub base. Some of these houses may already be suffering from damage as a result of seismic activity, or be of a form of construction which makes them more sensitive to damage from ground borne vibration. The Asian Development Bank (ADB) and Kyrgyz Republic Government have therefore retained EPTISA SA to oversee the construction. EPTISA in turn subcontracted Metropolitan Railway Consultants Ltd (MRCL), specialist noise and vibration engineers, to carry out a study to determine the potential effect of the vibration on nearby houses and potential means of mitigation to reduce the risk of damage.

The principal elements of the study are to:

- review existing vibration monitoring data obtained at dwellings alongside the road and if necessary to carry out additional measurements of ground borne vibration from the roller and excavator which are proposed to be used. A description of these measurements is set out in Section 2;
- review existing methods for calculation of vibration from ground preparation and compaction. An accepted method is described in Section 3;
- set vibration damage threshold levels for low, medium, high risk building classes (as determined by the Project Proponent) based on recognised International Standards. These are set out in Tabular form in Section 4;
- review and select appropriate criteria for the assessment of human response to vibration from construction activities. These are also set out in Section 4;
- review the effectiveness of potential methods of mitigation of ground borne vibration from vibratory compaction. The findings of the review are set out in Section 5;
- compare the results of the vibration monitoring with predictions made using the selected vibration model and if necessary to revise the prediction method to fit measured vibration data. Section 6 includes graphs showing this comparison and alternative probabilistic empirical relationships;
- calculate for normal operation of the roller the distance from the edges of the new road to each vibration damage (cosmetic) contour for low, medium and high risk building classes. The results of this are given in Section 6;
- re-calculate these distances taking into account the effectiveness of potential mitigation including for example use of low roller vibration settings. These results are also included in Section 6.
- EPTISA CAD team to plot vibration damage threshold contours on mapping of the scheme thus enabling buildings exceeding the respective thresholds to be identified.

2. SURVEY OF CONSTRUCTION VIBRATION LEVELS AT DWELLINGS

Monitoring Procedures

Vibration monitoring equipment comprised two Profund Vibra + vibration loggers, time synchronised, and 2 triaxial geophones. Geophone mounting procedures followed guidelines set out in British Standard BS ISO 4866 [5]. The reference geophone was mounted on the section of building foundation nearest the road by means of a bracket glued to the façade using structural adhesive (see Figure 1). The second geophone was mounted on a concrete paving slab, levelled and well bedded onto the ground surface using building sand (see Figure 2). At each building the geophone was initially mounted adjacent to the building, enabling the coupling loss between ground and building to be measured, and then moved to intermediate positions closer to the road as circumstances permitted. At all locations, the X and Y axes of the geophones were aligned transversely and parallel to the road, with the Z axis vertical.

The Vibra loggers were set to acquire maximum peak particle velocity and dominant frequency over contiguous 2 second intervals, and to acquire 2 second raw time histories and Fast Fourier Transform frequency analysis around each maximum peak event, be it a roller pass-by or impact resulting from operation of the excavator (see below).

The key item of plant in relation to vibration is the roller for which three pass-by events at high and low vibration settings were measured for each geophone configuration at each location. The number of passes was agreed with the Contractor as being the most which could be permitted given the potential of damage to the buildings. Measurements were also made at some locations of the roller operating without vibration.

During start up and run down, a vibratory roller will normally generate higher levels of vibration than during steady state operation, as was noted by Hiller and Crabb [3]. The rollers themselves have an automatic cut out which stops the vibratory action when the roller is at rest, preventing the formation of divots in the sub-base. Thus to avoid contamination of the measured data, the start and finish points of each pass were positioned at sufficient distance from the building to ensure that these higher levels of vibration would not affect the measurements.

At the first dwelling, vibration measurements were also made during operation of an excavator. In order to ensure vibration levels were representative of conditions likely to occur during the construction seasons i.e Spring-Autumn, the top few inches of ground, affected by ground frost were first removed before monitoring of the excavator was started.

Figure 1. Location of Geophone on Foundation of Building

Figure 2. Location of Geophone on Slab adjacent to Foundation

Selection of Vibration Monitoring Locations

Locations at a total of 8 single storey dwellings alongside the Bishkek-Kara Balta road were selected at which vibration measurements could be made, a number which would be considered to give a sufficiently large sample on which to base the analysis. Vibration measurements had to be representative of worst case levels during construction operations which required that the sub base was in place, and restricted measurements to the area where road construction had already started on Centralnaya Street in Petrovka. In the study by the UK Transport Research Laboratory [3] it was found that the levels of ground borne vibration increase with successive passes of the roller i.e. as the sub base gets stiffer. The sub base at locations in Petrovka have already been vibratory rolled and thus measured vibration levels would represent a worst case.

Figures 4-11 below show photographs of the selected dwellings, with some including details of the geophone mounting positions on the foundation. The location of the geophones and dwelling relative to the road is shown in Figure , with the distances between geophone positions and the road (d1-d3) given in Table 1. The last column of the Table also includes the measured coupling loss of each building.

A structural survey had previously been made at some of these buildings by The State Institute of Anti-Seismic Construction and Engineering Design (referred to in this report as the Institute) [15] and where appropriate some excerpts have been included in this document, mainly with reference to the building structure and damage. When referring to the structures of these houses, the Institute makes use of the term ‘concrete’ which includes clay based concrete.

The Institute reported that of the buildings surveyed almost all had foundations of ‘monolithic band rubble-concrete’ i.e. a band of cobblestone stones and rubble on clay mortar, with consequent facing work with concrete from the outside. Five of the 11 houses surveyed had walls of burnt bricks. In the remaining buildings, the walls were built of raw bricks or puddle clay, constructed by tamping the clay mortar into the formwork. The survey which was carried out after the vibratory rolling of the road widening, also found evidence of fresh cracks in building facades.

The Institute also carried out vibration monitoring at dwellings in Petrovka [16] however the results were reported in terms of acceleration rather than velocity, and hence the could not be directly used to evaluate building damage. Agreement was reached with the Institute that further analysis of the data could be carried out to give results in terms peak particle velocity, thus allowing the data to be included in the vibration modelling. To date only limited results have been provided and these were not considered sufficiently robust to be included in the overall dataset.

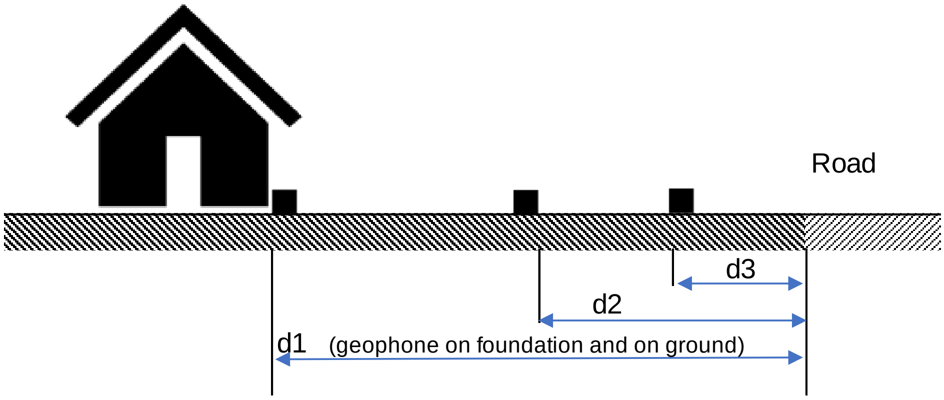


Figure 3. Location of Geophones and Dwellings relative to road

Address	**Distance to Geophone (m)**			**Coupling Loss**
	d1	d2	d3	
No. 85	14	7		1.21
No. 225	21.5	12	4	n/a
No. 105	10	3	n/a	1.03
No. 109	18	11	5	1.18
No. 393	18	9	5	0.84
No. 268	12	5	n/a	0.89
No. 214	10	6	3	0.82
No. 122	12	5	n/a	0.51

Table 1. Distances of Geophone positions from road

Figure 4. No. 85 Centralnaya Street, Petrovka

Construction: Clay/adobe construction with damage to external walls. The Institute [15] reported that the foundation is concrete and that the building has suffered medium damage.

Figure 5. No.225 Centralnaya Street, Petrovka

Construction: Clay/adobe construction with brick foundation. The Institute [15] reported that the foundation is concrete and that the building is weakly damaged. The nearest part of the area where rolling had been carried out here was adjacent to a culvert and the sub-base appeared to be shallow. Static deflection of the ground was visible during roller pass-by.

Figure 6. No. 105a Centralnaya Street, Petrovka

Construction: Clay/adobe construction. The Institute [15] reported that the foundation is constructed from reinforced concrete bands, and that the building has suffered medium damage.

Figure 7. No 109 Centralnaya Street, Petrovka

Construction: brick built but appeared to have some rubble in foundations.

Figure 8. No.393 Centralnaya Street, Petrovka

Construction: Clay/adobe construction. Unusually high levels of vibration both at the foundation and on the ground adjacent to the foundation led to limiting of tests to low vibration.

Figure 9. No. 268 Centralnaya Street, Petrovka

Construction: Mixed brick clay/adobe construction.

Figure 10. No 214 Centralnaya Street, Petrovka

Construction: Clay/adobe construction.

Figure 11. No. 122 Centralnaya Street, Petrovka

Construction: unknown however no visible sign of cracking and foundation appeared to be concrete.

Soil Conditions

A geological survey was carried out along the length of the road [14] and an excerpt is included in Appendix 1. This showed there to be little variation of the lithology along the route, with ground conditions comprising stiff to very stiff clay to sandy clay with gravel and pebble inclusion up to 30%. Therefore it was considered that the ground conditions at Petrovka, and hence levels of ground borne vibration could be taken as representative of the rest of the road.

Effect of Height of Water Table

A saturated soil may facilitate the propagation of vibration [11] in comparison with the unsaturated condition. However for construction operations such as ground preparation and excavation the bulk of the energy (c.67%) will propagate via surface waves, known as Rayleigh waves (see Terminology). The magnitude of the surface wave is largely unaffected by changes in the height of the ground water level, provided it remains sufficiently below the surface (relative to the wavelength). In the geological survey [14] it was reported that groundwater was not observed in the trial pits (c.2m deep) or open boreholes during excavations and drilling. Therefore the groundwater was not expected to occur close to the road surface and wave propagation should not be affected. One possible exception to this may be No. 225 Centralnaya St at which high ground water levels were reported during digging of the culvert. Measurements at this location showed unusually high levels of transverse vibration (X axis). however it was not clear whether this was a result of the very shallow sub base at this location or a high water table. Regardless of the cause, the results were not included in the dataset used in the modelling.

Frozen soil

Freezing of the soil may affect vibration propagation by reducing internal damping. During the first two days of the survey ground conditions were similar to those accompanying a hard frost and substantial deflection of the ground could be seen under the weight of the roller, indicating that the underlying soil was not frozen. On the third day of the monitoring, low overnight temperatures had resulted in an appreciable hardening of the ground surface as a result of freezing, however inspection of the results in comparison to previously measured vibration data showed there to be no significant effect on measured vibration levels.

Building Coupling Loss

The building coupling loss is defined as the ratio between free-field vibration levels and those measured on the building foundation. For a lightly built structure with limited foundations, this would normally be approximately 1, whilst for a typical brick built structure on a concrete foundation it would be 0.5. i.e. the level of vibration on the foundation would be approximately half that measured free-field outside the building at the same distance from the source of vibration.

3. CALCULATION OF CONSTRUCTION VIBRATION

Calculation of Vibration from Ground Compaction using Vibratory Roller

Hiller and Crabb [3] derived an empirical relationship for the calculation of vibration from from ground compaction based on an extensive measurement programme carried out by the UK Transport Research Laboratory (TRL). They found that for vibration from normal compaction passes the following empirical relationship could be used:

$$V_{res} = k_s\, n^{0.5}[\, A/(x+w)]^{1\ 5}$$

where:

V_{res} is the resultant level of vibration
k_s = 75, with a 50 per cent probability of the vibration level being exceeded;
k_s = 143, with a 33 per cent probability of the vibration level being exceeded;
k_s = 276, with a 5 per cent probability of the vibration level being exceeded;
n is the number of vibrating drums;
A is the nominal amplitude of the vibrating roller (mm);
x is the distance along the ground surface from the roller (m); and
w is the width of the vibrating drum (m).

The results obtained using this calculation method for the specification of the roller are compared with measured vibration levels in Section 6. It had been hoped to use the expression to calculate the vibration damage contour levels however it was not possible to get sufficient agreement with the measured data as will be discussed later.

For this study an empirical model was developed, similar to the TRL approach, with levels of vibration predicted using the upper bounds of the 95% and 66% prediction levels derived from a linear regression carried out on the transformed (natural logarithm) measured data for the high and low vibration roller operating modes. This approach is commonly used in the calculation of ground borne vibration from construction and transportation systems.

4. ASSESSMENT OF VIBRATION

Vibration Related Building Damage Criteria

International Guidelines and Standards present criteria for vibration related building damage in the form of threshold levels of vibration (peak particle velocity), as either a value or range of values.

Key factors in determine these levels are as follows:

- the nature of the building including its construction, its condition, and whether is of historic importance;
- the likely extent of damage i.e. cosmetic, minor structural or major structural; and
- whether the source of vibration is continuous or a single event and the dominant frequency (Hz)

A useful review of some of the Standards, largely of US origin, is presented in the Caltrans Guidance Manual [8], and this has been used as the basis of their own guideline values. On the whole these seem sensible, though they only set a threshold for cosmetic damage, do not specify a frequency range over which these limits apply, and appear to be overly conservative for industrial and framed buildings in comparison with European Standards.

Additional useful guidance is presented in the British and German Standards [6,7] both of which include a means of taking account of the variation of vibration damage threshold with frequency. In general, the threshold level at which vibration damage will occur increases with frequency. In common with the Caltrans guidance, both Standards differentiate between continuous and discrete vibration sources, with the threshold levels for continuous vibration being roughly half the equivalent level for single event vibration. Using both the Caltrans and BS definitions, vibrating rollers are classified as continuous sources of vibration.

The British Standard 7385 Pt 1 offers a means of qualitatively assessing the sensitivity of the building taking into account structure, condition and soil but does not provide a means of taking these factors into account in determining vibration damage threshold levels.

The British and German standards also offer guidance on the vibration levels at which the onset of minor structural damage might occur with these being roughly a factor of two higher than those for cosmetic damage. The definitions of cosmetic and minor structural damage set out in BS 7385 in are as follows:

> Cosmetic. The formation of hairline cracks on drywall surfaces or the growth of existing cracks in plaster or drywall surfaces; in addition, the formation of hairline cracks in mortar joints of brick/concrete block construction
>
> Minor Structural. The formation of large cracks or loosening and falling of plaster or drywall surfaces, or cracks through bricks/concrete blocks

The criteria which will be used in this study are a combination of the recommendations of the Standards and Guidelines thought most relevant and are set out in Table 2 below. Unless stated otherwise, they apply to the onset of cosmetic damage resulting from a continuous vibration source operating at a minimum frequency of 20Hz. Three classes of building are included as set out in the ToR, equivalent to low, medium and high risk of vibration damage. A description of the classes was originally intended to be supplied by the Project Proponent, however in the absence of guidance, reference has been made to International Standards and Guidelines, taking into account the type of building seen alongside the road. The majority of these buildings fall into the High Risk Class as they are of adobe/clay construction, which are referred to by the Institute as belonging to Class 9.5 in SNiP 22-01-98KR and are highly vulnerable.

However in the current study this Class is also considered to comprise two sub-classes, A with shallow footings (<1m), and B with concrete foundation/footings. Whilst the latter are likely to be less sensitive to ground borne vibration damage there is insufficient data in the literature on which to base a separate threshold for cosmetic damage and both must be classed as fragile buildings.

Human Response to Vibration: criteria

The British Standard BS 5228 sets out guideline values in terms of peak particle velocity for human response to construction works and these are shown out in Table 3 below. Column three includes semantic descriptors of the scale of vibration impact which are equivalent to those commonly used in the assessment of construction vibration.

The overall results of the assessment are to be presented in the form of building vibration damage contours hence the human response to vibration must be considered in relation to these contours.

Building Vibration Damage Risk Level	Building Description	Cosmetic Damage Threshold ppv (mm/s)	Source Reference for Criteria	Assumed Building Coupling Loss
	Extremely fragile historic buildings, ruins, ancient monuments	2	Caltrans/BART	n/a
High Risk A	Fragile buildings of clay construction with shallow (<1m) rubble footings	3	Caltrans	1
High Risk B	Fragile buildings of clay construction with concrete foundations/footings	3	Caltrans	0.5
Medium Risk	Residential brick built on concrete foundations/footings and light commercial	10	BS 7385/DIN 4150	0.5
Low Risk	Heavy commercial, industrial and framed buildings	25	BS 7385/DIN 4150	0.5

Table 2. Building Vibration Damage Assessment Criteria

Vibration Level ppv (mms^{-1})	Description of Effect	Description of Impact
<0.3	Vibration unlikely to be perceptible	Negligible
0.3 to 1.0	Increasing likelihood of perceptible vibration in residential	Minor
1.0 to 10	Increasing likelihood of perceptible vibration in residential environments but can be tolerated at the lower end of the scale if prior warning and explanation has been given to residents	Moderate
>10	Vibration is likely to be intolerable for any more than a brief exposure to a level of $10mms^{-1}$	Major

Table 3. BS 5228 Vibration Assessment Criteria

5. MITIGATION OF VIBRATION

Roller Vibration Setting

The calculation procedure described in Section 3 and the results of field measurements show that there is a clear reduction in vibration resulting from the use of a lower vibration level on the roller, though more passes of the roller may be required to achieve the same level of ground compaction. In theory, it may also be possible to achieve some mitigation by increasing the operating frequency of the roller as the threshold of building damage generally increases with frequency between 20 and 50Hz, as described in BS 7385 and DIN 4150. However it is not clear whether the frequency relationships in these Standards can be applied robustly to the building classes under consideration in this study.

It has recently been confirmed that on sections of the road adjacent to high risk buildings ground compaction can be carried out using a roller with no vibration. This would provide the most effective form of mitigation and would eliminate cosmetic damage resulting from vibration in the high risk buildings (within the measurement range).

A practical step which can be taken to mitigate vibration effects is to ensure that roller start up and shut down is carried out away from vibration sensitive properties as transient vibration levels during start up and shut down will generally exceed levels for steady state operation. Use of vibratory rollers directly atop the underlying soil adjacent to dwellings should also be avoided if possible. If compaction of the soil is required this should be done using a sheep foot type roller or a non-vibratory roller as suggested by the contractor (see below).

Use of Alternative Compaction Equipment

The contractor China Railway Company has suggested that sufficient compaction of the sidewalk sub-base and the sides of embankment can be achieved using a rubber tyre roller as shown in Appendix II.

An alternative vibratory roller was also suggested (XS 350) however on inspection it was not clear, using the TRL calculation method described earlier, that this model would offer any reduction in vibration. The manufacturers specification indicated that the amplitude of vibration was higher than the existing model. Selection of an alternative lower vibration roller would still offer a means of providing additional mitigation.

Trench

It has been proposed by the Contractor that the depth of the drainage channel proposed to run alongside extensive sections of the road could be temporarily increased during the construction of the road. This would enable it to function as a trench providing vibration isolation to properties alongside the road from operation of the roller.

The results of experimental work examining the effectiveness of trenches agree that the degree of attenuation which can be achieved is a function of the depth of the trench in relation to the incident Rayleigh wavelength. The depth of the trench is sometimes expressed in these studies as a fraction of wavelength, thus in order to determine the depth an effective trench of it necessary to calculate the wavelength in the local soil conditions along the road. Assuming that the Rayleigh wave speed in the soil (of the type prevalent adjacent to the road) is c. 140m/s and the main frequency of concern to be c. 20Hz, this would give a wavelength of c.7m.

Richart [4] reports studies showing that reductions of 75- 50% were readily achievable with a trench at depth of 0.6 times Rayleigh length wavelength, which for the current study would be 4.2m. The studies showed that the highest levels of attenuation were achieved close to the trench, and that the screened area extended to a distance of at least ten wavelengths from the trench.

Barkan [13] suggested that the depth should not be less than 0.3 times the wavelength i.e. 2.1m, whilst in [12] Thompson reports experimental results showing a vibration reduction in the order of 10dB (c.65%) at frequencies of 16Hz and above using a trench of 3.5m in depth.

The Institute carried out some initial tests [17] in which they measured the degree of attenuation of vibration (acceleration) from the roller which could be achieved using trench depths of 1.5 and 2.0 at a distance of c.6m from the trench. With a depth of 1.5m they reported reduced levels of vibration of between 2-4 times the level without the trench.

Taking into account the review of the work above, it has been assumed in the calculations that it would be possible to achieve an attenuation in levels of ground-borne vibration of the order of c. 50% using a trench alongside the road. The depth of the trench would be likely to be between c.1.5-3m. However this assumption would need to be confirmed by carrying out some additional vibration measurements prior to resuming construction works.

Human Response

Adverse human response to construction vibration can be mitigated by good communication between the contractor and local residents. If occupiers of dwellings are informed prior to the works of their nature, duration and potential vibration effects, then adverse response will be less. Generally the main concern relating to construction vibration is of damage to property and if this is not likely to occur, the point should be made strongly to residents.

6. RESULTS

Vibratory Compaction

The vibration time histories of roller pass-by were processed to provide the maximum peak particle velocity (ppv) for each pass-by thus giving c. 3 data points for each roller vibration setting/geophone configuration. A combined plot of vibration and dominant frequency against time (see Figure 12 below) was examined for each data point to ensure that the roller had reached normal operating frequency and that the higher levels occurring during start up were not contaminating the measured data. This was supplemented by looking at more detailed vibration frequency information contained in the Fourier transform (FFT) of the individual measurements made during pass-by. Examples of these are presented in Figures 13 and 14 overleaf.

Figure 12. Combined Plot of Velocity and Frequency v Time for 3 Roller Pass-bys

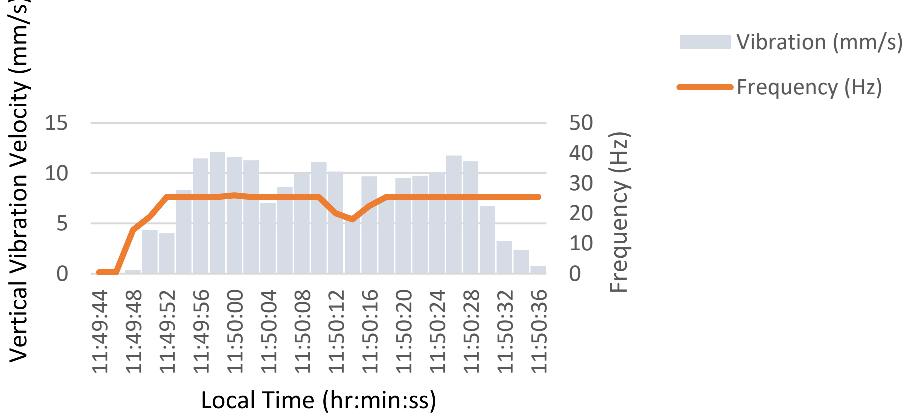
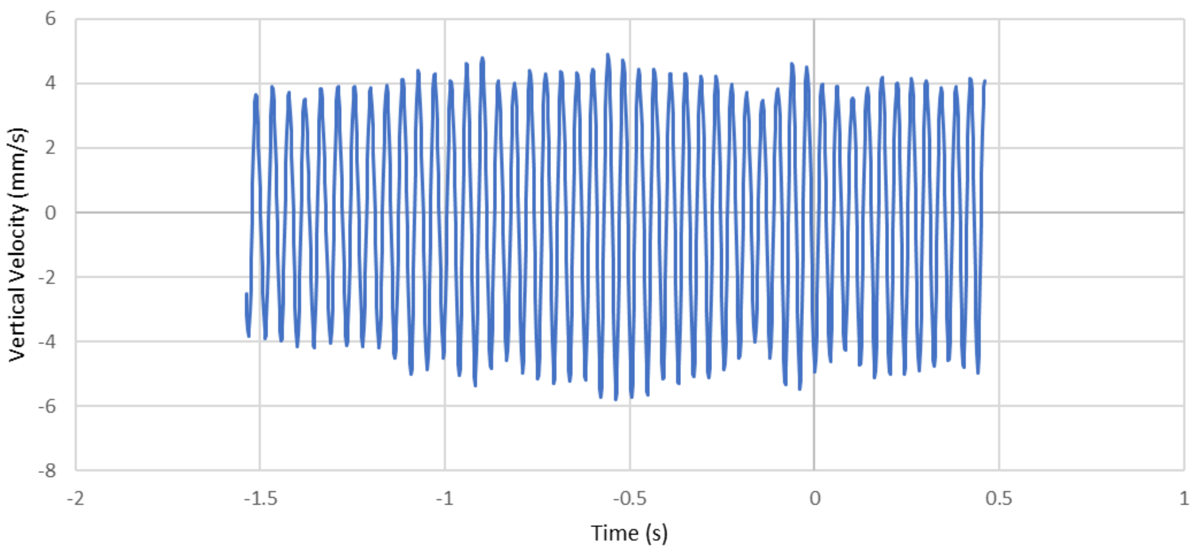
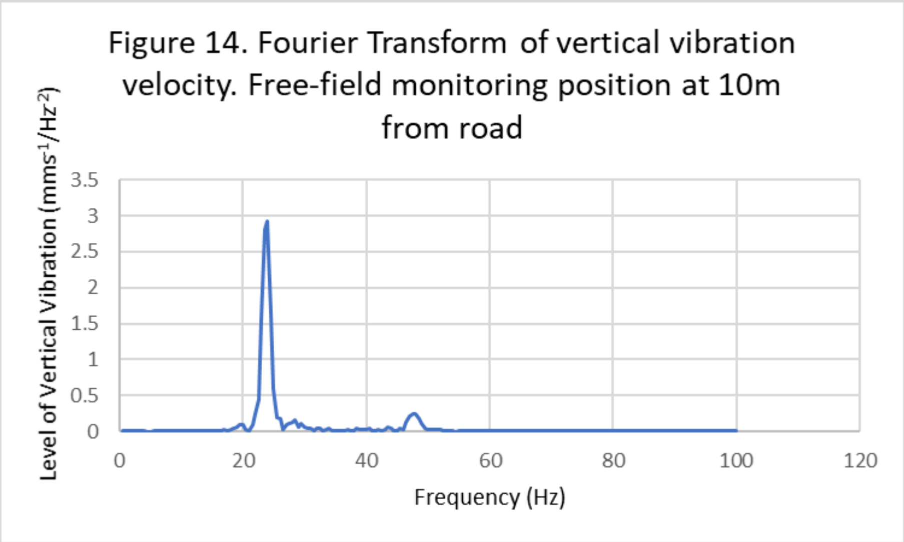


Figure 13. Vertical Velocity Time History
Free-field monitoring position at 10m from road





Levels of vibration during normal operation of the roller, both freefield (see Terminology) and measured on the foundation, were found to be dominated by the vertical (z) component (see Terminology), and thus in this study only the vertical components have been considered.

The objective of the data analysis was to compare the results of the vibration monitoring with predictions made using the TRL vibration model described earlier and if necessary to revise the prediction method to fit measured vibration data. This would give an empirical relationship, based on the results of field measurements, between the distance from the construction activity and the peak particle velocity at a building foundation. This relationship would then allow the distance to be determined at which the threshold vibration levels for cosmetic damage would no longer be exceeded, referred to in this study as a vibration damage contour.

A ‘log- log’ plot of the data for both high and low vibration of the roller is presented in Figure 15. The data show a high degree of scatter which is similar to that found in the TRL study. The lines on the graph show a best fit using a power regression to the non transformed data however a better fit were subsequently found using a linear regression to the transformed (logarithmically) data,

Initial inspection showed that the measurements made at No 363 were very much outside expected results and therefore data from this location was not included in the statistical analysis of results. In particular at this location, vibration was seen to be increasing with distance away from the road, probably due to the effect of some local ground condition.

Tabular results of the measurements at each location are set out in Appendix III. The Tables include the address and geophone location (column 1), date and time (columns 2 & 3), measured peak particle velocity (mm/s) and the dominant frequency. The two geophone/logger combinations are referred to by the serial numbers i.e no. 3532 which was placed on the ground for all measurements and no. 3311 which was attached to the foundation.

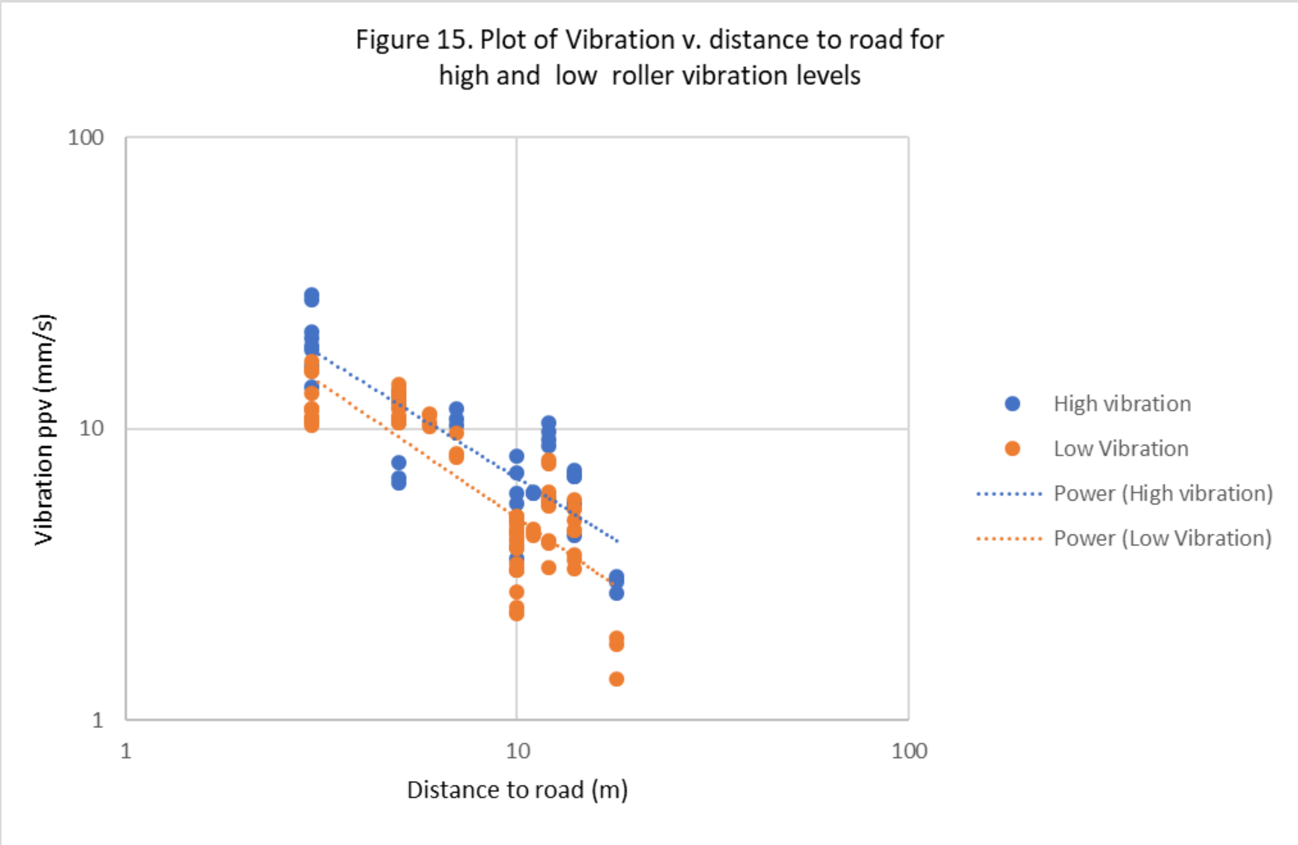


Figure 15. Plot of Vibration v. distance to road for
high and low roller vibration levels
Vibration ppv (mm/s)
100
10
1
1
10
100
Distance to road (m)
High vibration
Low Vibration
Power (High vibration)
Power (Low Vibration)

Comparison of Building Foundation versus Free-field Vibration Levels

One of the objectives of the monitoring was to quantify the coupling loss, if any, of the building foundations. This is defined as the ratio between free-field vibration levels and those measured on the building foundation. For a lightly built structure with limited foundations, this would normally be approximately 1, whilst for a typical brick built structure on a concrete foundation it would be 0.5. i.e. the level of vibration on the foundation would be approximately half that measured free-field outside the building at the same distance from the source of vibration.

The coupling loss for the buildings in the study, determined from the results of monitoring was shown earlier in Table 1. It can be seen that with one exception the loss is between c. 0.8 and 1.2 indicating that at some locations the levels of vibration measured on the foundation are slightly higher than free-field vibration. This could be the result of a building structural resonance however the most likely explanation is that the coupling of the free field slab and geophone is less than that of the building to the ground.

The exception to these findings was the coupling loss of 0.5 found at No. 102 Centralnaya Street. This building was thought to be of adobe construction however it was not possible to determine the nature of the foundations i.e whether the adobe walls were constructed on a concrete strip foundation, which would have reduced vibration levels at the foundation. However in order to maintain the accuracy of vibration prediction, vibration data measured on the foundation of this building were not included in the data set used as the basis of predictions.

This predominance of buildings which are well coupled to the ground (i.e the coupling loss is approximately unity) could partly explain the particular problems encountered during the initial construction of the road between Bishkek and Kara-Balta. The limited attenuation of ground-borne vibration as it enters the building means the level of structural vibration is already roughly double the level that would be found on an equivalent brick built building (on concrete foundations). This is compounded by the fragile nature of the adobe clay/adobe construction, resulting in buildings that are much more vulnerable to vibration damage.

Statistical Analysis of Data

A linear regression was used to derive a relationship between the transformed vibration data and the distance from the roller, for both high and low vibration roller operating modes. The results are shown in Figures 16 and 17. Using this expression and the data from which it has been derived it is possible to calculate what are referred to as prediction intervals, with the 95% and 66% prediction intervals commonly used. The 95% prediction interval is the interval centred about the vibration levels calculated usingthe derived expression, within which there is a probability of 95% that the vibration data will occur. The upper boundary (or upper bound) of this interval is referred to as the 95% prediction level and there is a 5% probability that vibration levels will lie outside the interval. Figures 16 and 17 include the upper bounds of the 95% and 66% prediction levels based on the measured vibration data, and the upper bound of the 95% prediction level using the TRL calculation methodology. It can be seen that the data on both plots show considerable scatter around the levels calculated using the derived expression. For the roller operating in high vibration mode, the TRL 95% upper bound is higher than the measured data though it converges to good agreement at c.20m distance from the road.

However for the roller operating in low vibration mode, shown in Figure 17, the TRL 95% upper bound prediction level is lower than the measured data indicating that the degree of mitigation predicted using the TRL model using lower levels of amplitude of vibration of the roller is too great.

In addition, in both cases the rate of attenuation with distance predicted using the TRL calculation method is high in comparison with the measured data and thus taking into account these factors, the TRL method cannot be used for the prediction of the vibration damage contour distances required as the output of the study. Instead the contour distances will be predicted using the upper bounds of the 95% and 66% prediction levels derived from the best fit (linear regression of transformed data) to the measured data for the high and low vibration roller operating modes. This approach is commonly used in the calculation of ground borne vibration from construction and transportation systems.

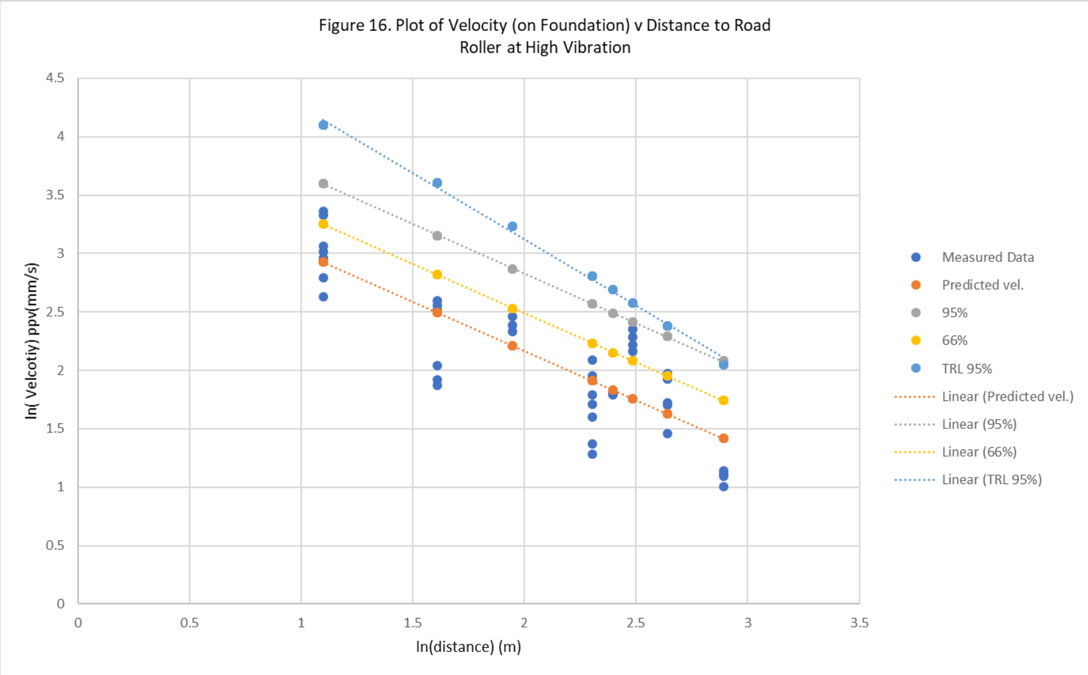


Figure 16. Plot of Velocity (on Foundation) v Distance to Road
Roller at High Vibration
ln(Velcotiy) ppv(mm/s)
ln(distance) (m)
Measured Data
Predicted vel.
95%
66%
TRL 95%
Linear (Predicted vel.)
Linear (95%)
Linear (66%)
Linear (TRL 95%)

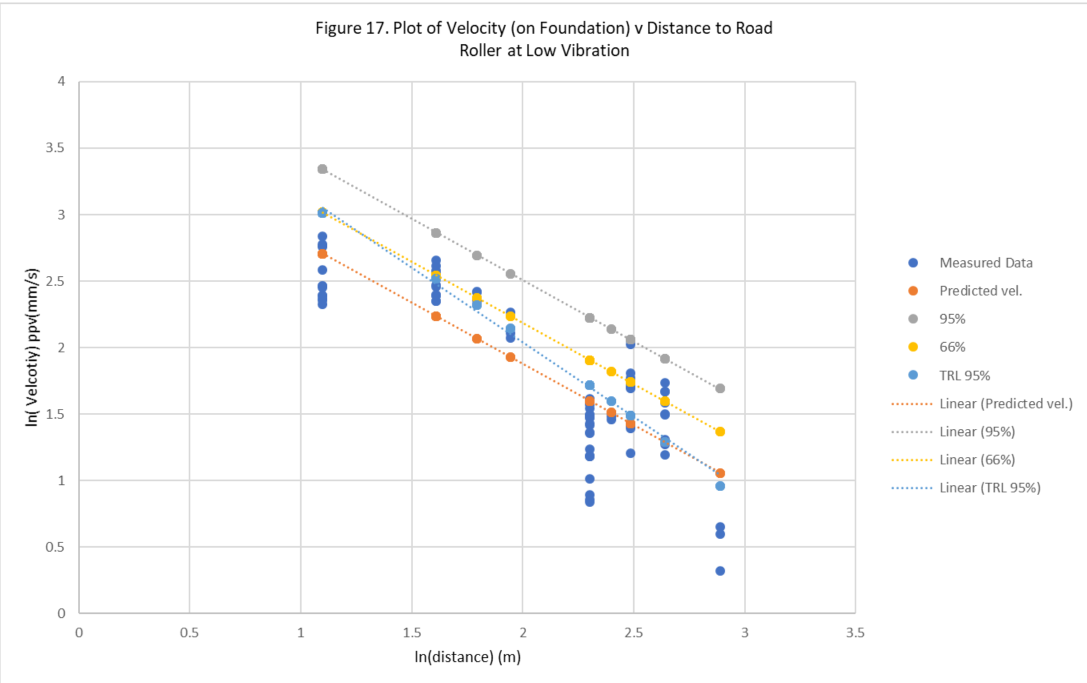


Figure 17. Plot of Velocity (on Foundation) v Distance to Road
Roller at Low Vibration
ln(Velcotiy) ppv(mm/s)
ln(distance) (m)
Measured Data
Predicted vel.
95%
66%
TRL 95%
Linear (Predicted vel.)
Linear (95%)
Linear (66%)
Linear (TRL 95%)

Vibration Damage Contour Distances

Options are set out below for vibration damage contour distances for both high and low vibration levels of the roller including graphical illustration of the respective distances to the vibration damage (cosmetic) contours. These are the distances from the road beyond which the risk of vibration damage (cosmetic) reduces below 5% (for 95% prediction level), or 33% (for the 66% prediction level).

Whilst these are included for building classes at high, medium and low risk of vibration damage, the discussion in each section is restricted to the high risk building class i.e. clay/adobe construction as these constitute the majority of the buildings alongside the Bishkek-Kara-Balta Road. Predicted levels are also given assuming the use of an over excavated drainage channel to provide vibration mitigation. It should be noted that predictions outside the range of the site measurements i.e. c.3-25m will be of reduced accuracy.

Whilst detailed options are discussed below, a Summary Table is presented at the end of the section based on recommendations.

<u>High vibration mode</u>

Option 1. Upper bound of 95% prediction level for Cosmetic Damage

Using the upper bound of the 95% prediction level taken from Figure 16 and criteria taken from Table 2, the distance to the vibration damage (cosmetic) contour for high risk buildings is predicted to be 57m. This will include many of the dwellings directly alongside the road which are constructed from clay/adobe. In areas where an over excavated drainage channel can be used as a trench it is predicted that this contour distance could be reduced to 25m for high risk buildings. However, as discussed earlier, the distribution of the data on which predictions are based has increased the width of the 95% prediction band giving an overly conservative result and Option 2 below would offer a more practicable approach.

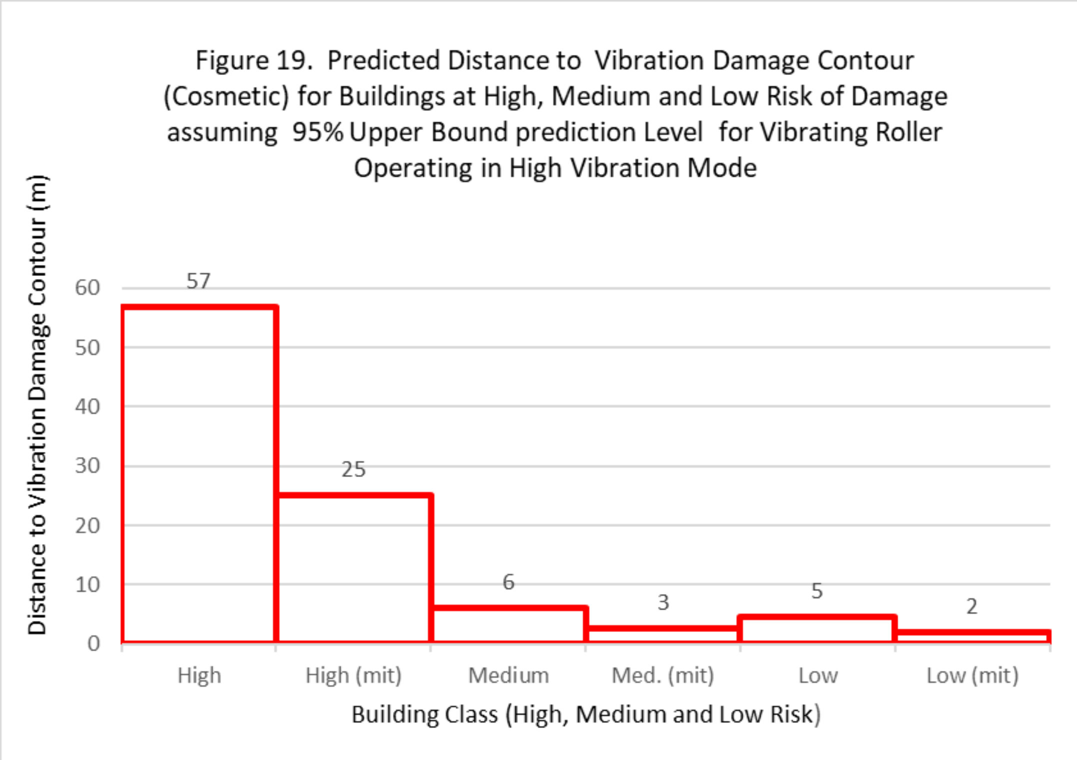
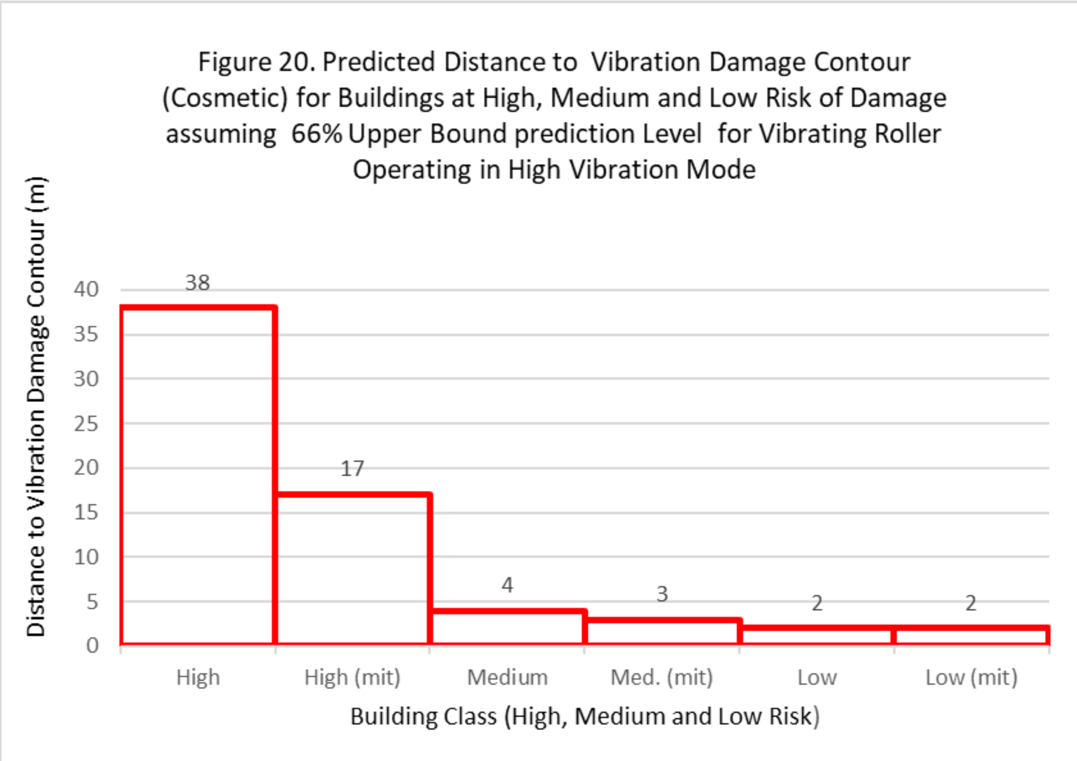


Figure 19. Predicted Distance to Vibration Damage Contour (Cosmetic) for Buildings at High, Medium and Low Risk of Damage assuming 95% Upper Bound prediction Level for Vibrating Roller Operating in High Vibration Mode
Distance to Vibration Damage Contour (m)
0
10
20
30
40
50
60
57
25
6
3
5
2
High
High (mit)
Medium
Med. (mit)
Low
Low (mit)
Building Class (High, Medium and Low Risk)

Option 2. Upper bound of 66% prediction level for Cosmetic Damage

A more practicable approach would be to use the upper bound of the 66% prediction level as the basis of prediction of the cosmetic damage contour distance. Using this prediction level, the distance to the vibration damage contour would be 38m, which would reduce to 17m, taking into account the addition of mitigation in the form of an over excavated drainage channel. There is also good agreement with the TRL 95% upper bound prediction level at this distance, which without mitigation would give the distance to the vibration damage contour to be 35m.



Option 3 Minor Structural Damage 95% prediction level-high risk class buildings

An alternative approach would be to accept that some risk of cosmetic damage is an unavoidable consequence of the construction of the road and to set a threshold level at which minor structural damage might occur at high risk buildings. Using the guidance set out in BS 7385, minor structural damage would occur at approximately double the peak particle velocity for cosmetic damage, giving a threshold level for high risk buildings of 6mm/s. However it should be noted that in applying the multiplication factor BS 7385 makes no differentiation between buildings in good condition and those with previous cosmetic or structural damage. Thus if a criterion of minor structural damage is to be used as the basis of vibration damage, careful monitoring of building condition and vibration levels would need to be carried out during initial works.

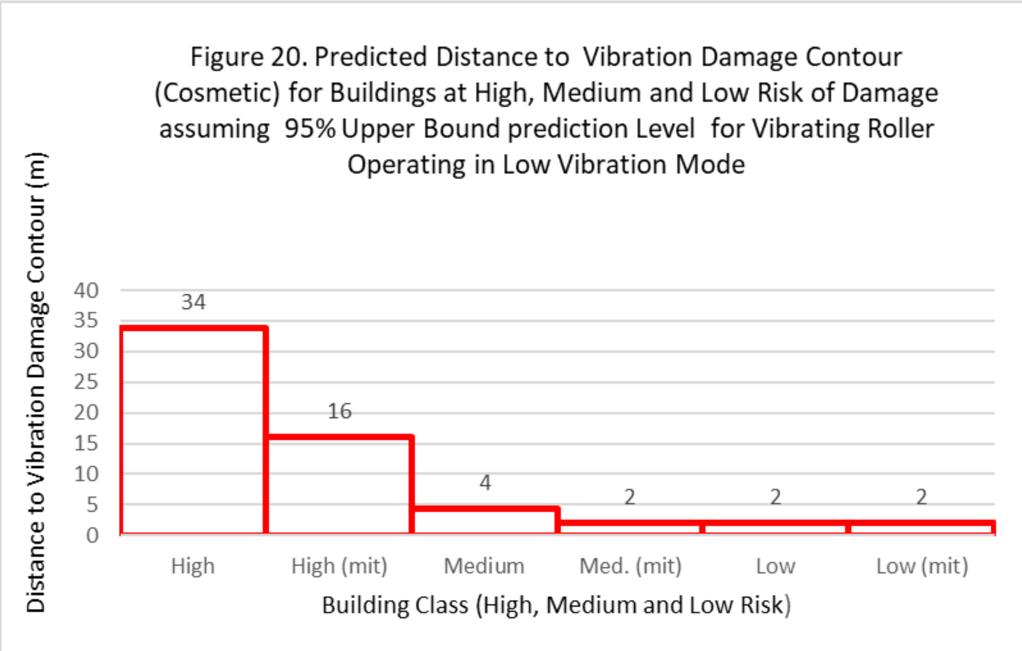
For high vibration mode using the upper bound of the 95% prediction level, the distance to the minor structural damage contour would be predicted to be 25m, reducing to 11m with the provision of mitigation. The equivalent distance given by the TRL 95% prediction level would be 22m, assuming no mitigation.

If the adoption of minor structural damage as the basis of a vibration damage contour were considered, it would entail higher risk in terms of implications i.e. cost of potential building repair etc and the use of the 66% upper bound prediction level would not be advisable.

Roller Low vibration mode

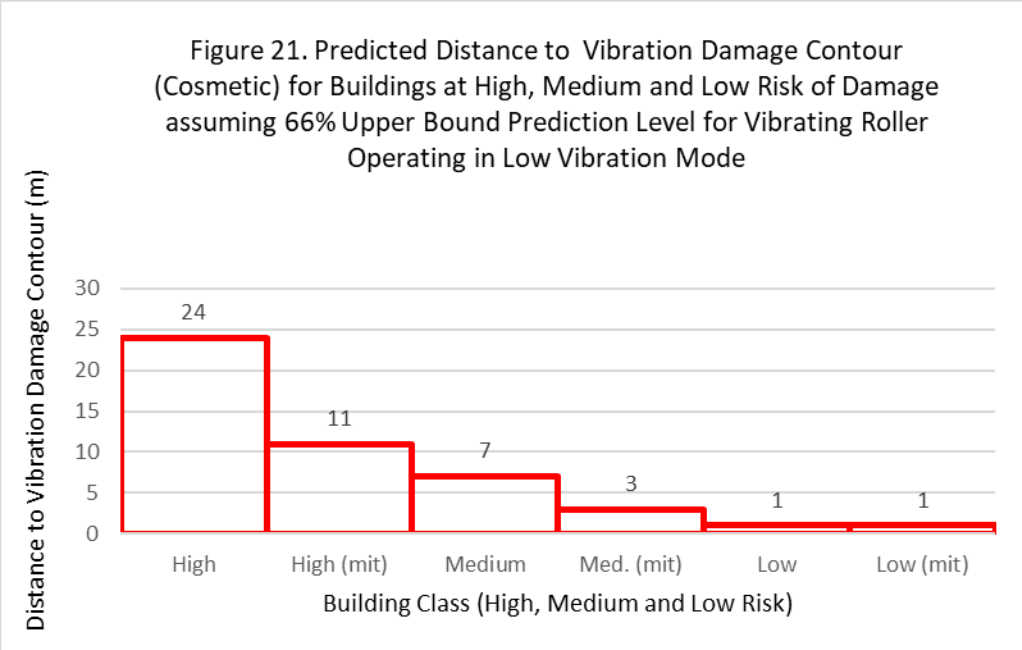
Option 1. Upper bound of 95% prediction level for Cosmetic Damage

Using the upper bound of the 95% prediction taken from Figure 20 below, the distance to the vibration damage (cosmetic) contour for high risk buildings is predicted to be 34m. In areas where an over excavated drainage channel can be used as a trench it is predicted that this contour distance could be reduced to 16m. This Option is considered over conservative.



Option 2. Upper bound of 66% prediction level for Cosmetic Damage

An alternative approach again would be to use the upper bound of the 66% prediction level as the basis of calculation of the cosmetic damage contour distance, giving a distance of 24m to the vibration damage contour without any form of mitigation such as a trench. The addition of mitigation in the form of an over excavated drainage channel would reduce the vibration damage (cosmetic) contour distance to 11m.



Option 3 Minor Structural Damage 95% prediction level-high risk class buildings

As described earlier, an option would be to set a vibration damage threshold level which at minor structural damage might occur at high risk buildings. For low vibration mode using the 95% upper bound prediction levels, the distance to the minor structural damage contour would be predicted to be 16m, reducing to 8m with the provision of mitigation. The equivalent distance given by the TRL 95% upper bound prediction level would be 9m, assuming no mitigation.

Summary of Recommendations

Vibration Damage Contour Distances for Operation of Vibrating Roller

Table 22 below summarises the recommended predicted vibration damage contour distances for cosmetic and minor structural damage to high risk building for high and low vibration settings of the roller. Predicted contour distances are also included taking account of the use of a trench.

Roller Vibration Setting	**Mitigation Option**	**Vibration Damage Contour Distance (m)**		
		Cosmetic Damage 66% Prediction level	**Cosmetic Damage** 95% Prediction level	**Minor Structural** 95% Prediction level
High	No mitigation	38	57	25
Low		24	34	16
High	Mitigation (trench)	17	25	11
Low		11	16	8

Table 22. Vibration Damage Contour Distances for High Risk Buildings

Plotting of Vibration Damage Contour Distances

The final stage of this study has involved the EPTISA CAD team plotting vibration damage threshold contours on mapping of the scheme thus enabling buildings exceeding the respective thresholds to be identified. The Plans, which are presented in Appendix IV, are based on the contour distances set out in Table 22, but also take account of the following recommendations. The Plans:

- only show contours for high risk buildings, as they are much more likely to suffer building damage and also because the brick built housing (medium sensitivity) is intermingled with housing constructed from adobe and in practice it may be difficult to carry out selective rolling of the road (i.e. high/low vibration in an area of mixed building type;
- only show contours for low vibration operation of the roller as high vibration operation is impracticable in these mixed building type residential areas;
- show the effect of mitigation provided by a trench where this is practicable; and
- show contours for both cosmetic damage and minor structural damage.

In the preparation of the Plans, the contour distances have been taken from the outermost construction point assuming that ground preparation of the sidewalk and embankment will be carried out using a vibratory roller.

Roller No Vibration Mode

It has recently been confirmed that it is possible to carry out ground compaction without vibration on sections of the road adjacent to high risk buildings.

Measurements were made using the no vibration mode at two locations to verify levels of vibration and results shown in in Appendix I Table AI.7. At both locations vibration levels made at distances of 3-5m were less than a third of the threshold level at which a risk of cosmetic damage would be identified at a high risk class building i.e adobe/clay construction.

Vibration from Operation of Excavator

The measured vibration velocities (ppv) during excavation of the prepared sub base on the house foundation (No 85) and on the slab 7m from the road are shown in Appendix I Table AI.6. An expression obtained by fitting of a linear regression of the transformed data gives the distance to the high risk building class contour (3mm/s) of 5.2m Thus this result indicates that where excavation e.g. of drainage channels, is carried out at distances any less than 5.2m from a high risk building there may be a risk of cosmetic damage. The equivalent distance in order to reduce risk of minor structural damage would be c.2m

Example: Assessments of Risk of Vibration Building Damage (Cosmetic) from a Roller operating at high vibration setting 20m from a dwellings in the high and medium risk building classes and a vibration prediction level of 66%

High Risk Class-e.g. adobe on shallow footing

The level at which there is risk of vibration damage (cosmetic) to this type of building is taken from Table 2 as 3mm/s. Referring to Figure 16, taking the natural logarithm of 3 on the y axis (vibration), and using the 66% prediction level (the light brown line) this corresponds to a distance of 38m on the x axis (distance). This result is illustrated in Figure 20. The building lies closer to the roller than 38m therefore it is at risk of cosmetic damage.

Medium Risk Class-brick built structure on concrete foundation

The level at which there is risk of vibration damage (cosmetic) to this type of building is taken from Table 2 as 10 mm/s, which taking into account the coupling loss for this type of building is equivalent to a ground vibration level of 20mm/s. Referring to Figure 16, taking the natural logarithm of 20 on the y axis (vibration), and using the 66% prediction level (the light brown line) this corresponds to a distance of 4 m on the x axis (distance). This result is also illustrated in Figure 20. The building lies considerably further away from the roller than 4m therefore would be unlikely to be at risk of cosmetic damage.

7. CONCLUSIONS

MRCL has carried out a study of construction vibration at dwellings alongside the Bishkek Kara Balta Road in order to determine the potential effect of the vibration on nearby houses and potential means of mitigation to reduce the risk of damage.

Existing vibration monitoring data obtained at dwellings alongside the road have been reviewed and additional measurements of ground borne vibration from the roller and excavator have been obtained. A review has also been made of existing methods for calculation of vibration from ground preparation and compaction, and vibration damage threshold levels for low, medium and high risk building classes have been set, based on recognised International Standards.

The effectiveness of potential methods of mitigation of ground borne vibration from vibratory compaction have been examined including the use of low vibration operation of the roller and the use of trenches, formed by over excavation of proposed drainage channels. It was concluded that both these options offered significant levels of mitigation, though further measurements would be needed prior to construction to confirm the effectiveness of the trench.

The results of the vibration monitoring were compared with predictions made using the vibration model developed by TRL. The comparison showed the model to over predict attenuation of vibration with distance and also to overpredict the mitigation which could be obtained using a lower amplitude of roller vibration. However whilst the model itself could not be used, empirical relationships of a similar nature, based on statistical analysis of the measured data were derived.

These relationships were used to predict vibration damage contours (cosmetic) for low, medium and high risk building classes for high and low vibration roller operating modes. These are the distances from the road beyond which the risk of vibration damage (cosmetic) reduces below 5% (for 95% prediction level), or 33% (for the 66% prediction level). The contour distances were set out in diagrammatic form for each of these modes and prediction levels.

For the high vibration operating mode, the predicted distance to the vibration damage contour for cosmetic damage to high risk buildings would be 38m. The addition of mitigation in the form of an over excavated drainage channel i.e. a trench, would reduce the vibration damage (cosmetic) contour distance to 17m.

In the case of the low vibration operating mode, the predicted distance of to the vibration damage contour for cosmetic damage to high risk buildings would be 24m. This would reduce to 11m, taking into account the use of a trench as mitigation.

An alternative approach to the assessment was also considered based on the premise that risk of cosmetic damage may an unavoidable consequence of the construction of the road and to instead set a threshold level at which minor structural damage might occur. This would be approximately double the threshold for cosmetic damage, and for high risk buildings would be 6mm/s.

For high vibration mode the predicted distance to the minor structural damage contour for high risk buildings would be 25m, reducing to 11m with the provision of mitigation. The equivalent distance predicted by the TRL method would be 22m, assuming no mitigation.

For low vibration mode the predicted distance to the minor structural damage contour for high risk buildings would be 16m, reducing to 8m with the provision of mitigation. The equivalent distance given by the TRL prediction would be 9m, assuming no mitigation.

Vibration measurement were carried out during the excavation of the prepared sub base. The results indicated that the distance to the high risk building class contour (cosmetic damage) was 5.2m. i.e where excavation e.g. of drainage channels, is carried out at distances any less than 5.2m from a high risk building there may be a risk of cosmetic damage.

In the final stage of the study the EPTISA CAD team plotted vibration damage threshold contours on mapping of the scheme to produce Plans which illustrate the risk of cosmetic and minor structural damage to high risk buildings alongside the road. These are presented in Appendix IV.

The Table below gives simplified guidance to contractors on roller vibration settings and distances from the roller at which there is a risk of cosmetic or minor structural damage at high risk buildings (adobe).

Roller Vibration Setting	**Mitigation Option**	**Vibration Damage Contour Distance (m)**	
		Cosmetic Damage	**Minor Structural**
High	No mitigation	38	25
Low		24	16
High	With Trench	17	11
Low		11	8

Terminology

Rayleigh Wave

A type of wave, discovered by Lord Rayleigh in 1885, that can propagate on the surface of the ground. The motion of the wave, also known as an R-wave, is confined to a zone near the surface and consists of horizontal and vertical components that attenuate rapidly with depth.

Peak Particle Velocity (ppv)

This measure of velocity is used to describe vibration in the ground and in structures in terms of the motion of a particle (i.e., a point in or on the ground or structure) and is the zero-to-peak amplitude of velocity of the particle. It is generally accepted as the most appropriate descriptor for evaluating the potential for building damage. However it can also be used to assess human response to vibration from construction. It is normally measured on three orthogonal axes which, for example at a point near a road would be, transverse (x), longitudinal (y) and vertical (z). Often vibration levels will dominated by the vertical component of velocity however in multi-storey buildings, transverse vibration , resulting from rocking of the building may be important.

Free-field Vibration Level

This is the level of vibration measured on the ground using a geophone mounted on a slab, stake or embedded in the ground. It is generally higher than the equivalent level of vibration that would be measured on a building foundation.

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17. State Agency of Anti-Seismic Construction and Engineering Design. Seismologic Report. Trenching Method. Chapter 3. 2017

APPENDIX I.

SOIL CONDITIONS

Stiff to very stiff clay to sandy clay with gravel and pebble inclusion upto 30%. The presence of Groundwater was not found in the trial pits or open boreholes. Therefore ground water was not expected to occur close to the road surface. The subgrade of the existing road is paved with road side reserves materials, where soils is light loamy silt soil rarely with gravel and pebble inclusion up to 30% .In the carriageway under the granular material layer, subgrade is present, but this soil could be the component of the higher embankment material; but due to the limited depth of site investigation it can not be assessed.

Disturbed samples were taken from trial pits. The tested samples of subgrade material vary from clay to sandy clay with low to medium plasticity.

The particle size distribution analyses for the 7 samples of the subgrade are provided results summarized as follows:

Gravel (>2 mm size): 2 - 22%

Sand (0.075 mm to 2 mm size): 2 - 9 %

Silt and Clay (< 0.075 mm size): 76 - 96 %

Based on the fine content, the cohesive subgrade material has been classified as silt containing very little sand and some gravel

APPENDIX II. DETAILS OF VIBRATING ROLLERS

Model: Shandong Engineering Machinery SEM 520

All-wheel hydraulic drive,

Working weight :20000kg.

Load on the front drum: 13500kg.

Linear load 612 N/cm

Max. speed 10 km/h

Vibration frequency (min/max) 28/33

Amplitude of vibrations (max/min) 1,86/0,93 mm

Vibration strength (max/min) 370/255 kN

Diameter of the drum :1600 mm.

Width of the drum: 2130 mm.

XCMG XP303K Pneumatic Tyred Road Roller

APPENDIX III.

RESULTS OF VIBRATION MONITORING

Address	Date	Time	Vibra 3532 Z [mm/s]	Dom. Freq. Z [Hz]	Time	Vibra 3311 Z [mm/s]	Dom. Freq. Z [Hz]
No 85	12/12/2017	10:44:00	5.69	19	10:44:00	7.18	19
high vib							
both at foundation							
low vib	12/12/2017	10:59:30	4.45	24	10:59:30	5.32	24
both at foundation	12/12/2017	11:01:00	4.19	25	11:01:00	5.69	25
	12/12/2017	11:01:30	3.55	25.5	11:01:30	4.48	25.5
high vib	12/12/2017	11:19:30	8.47	18.5	11:19:30	7.08	20
35 at 7m posn	12/12/2017	11:20:00	8.95	22	11:20:00	6.86	21.5
	12/12/2017	11:20:30	9.68	22	11:20:30	6.85	22
low vib	12/12/2017	11:33:30	6.57	24.5	11:33:30	4.88	25
35 at 7m posn	12/12/2017	11:34:30	7.94	25	11:34:30	5.31	25
	12/12/2017	11:35:57	6.79	25.5	11:36:00	4.47	25.5
high vib	12/12/2017	12:15:30	11.47	22	12:15:30	5.59	21
35 at 3m position	12/12/2017	12:17:00	15.39	25.5	12:17:00	5.48	23
	12/12/2017	12:17:30	13.44	25.5	12:17:30	4.29	24
low vib	12/12/2017	12:24:30	8.68	25	12:24:30	3.7	24.5
35 at 3m position	12/12/2017	12:25:30	9	25	12:25:30	3.56	25.5
	12/12/2017	12:26:30	8.45	25.5	12:26:30	3.31	25.5

Table AI.1 Results of Vibration Monitoring at 85 Centralnaya Street, Petrovka

Address	Date	Time	Vibra 3532 Z [mm/s]	Dom. Freq. Z [Hz]	Time	Vibra 3311 Z [mm/s]	Dom. Freq. Z [Hz]
No 105	13/12/2017	10:15:32	4.41	17	10:15:32	6.01	17
high vib	13/12/2017	10:17:24	6.21	19.5	10:17:24	8.06	20
both at foundation							
low vib	13/12/2017	10:24:28	4.94	23.5	10:24:28	4.83	24
both at foundation	13/12/2017	10:26:12	4.2	25	10:26:12	4.17	25
	13/12/2017	10:28:00	4.49	25	10:28:00	4.13	25
high vib at 3m	13/12/2017	10:34:34	18.71	22.5	10:34:34	7.06	21.5
	13/12/2017	10:34:40	28.02	22	10:34:40	4.96	22
	13/12/2017	10:35:22	19.78	23.5	10:35:22	5.53	23.5
low vib	13/12/2017	10:37:12	16.59	25.5	10:37:12	2.35	25.5
at 3m from rd	13/12/2017	10:37:14	15.35	25.5	10:37:14	2.75	25.5
	13/12/2017	10:38:30	15.56	25.5	10:38:30	2.44	25.5

Table AI.1 Results of Vibration Monitoring at 85 Centralnaya Street, Petrovka

Address	Date	Time	Vibra 3532 Z [mm/s]	Dom. Freq. Z [Hz]
No 109				
high vib on wall	13/12/2017	11:32:04	3.05	22
low vib	13/12/2017	11:34:12	1.82	21
on wall	13/12/2017	11:35:26	1.92	24.5
on ground	13/12/2017	11:37:28	2.98	20.5
by wall	13/12/2017	11:38:14	2.74	20
high vib				
plate nr found	13/12/2017	11:40:24	1.53	23.5
low vib	13/12/2017	11:41:32	1.38	25
high vib	13/12/2017	11:44:46	5.01	20.5
11m from rd	13/12/2017	11:45:36	4.93	20
(and 7 from hse)	13/12/2017	11:46:00	4.96	21
low vib	13/12/2017	11:47:14	3.64	25.5
11m from road	13/12/2017	11:47:30	3.55	25.5
	13/12/2017	11:48:32	3.73	25.5
high vib	13/12/2017	11:51:50	10.65	21
5m from road	13/12/2017	11:52:34	10.18	21
low vib	13/12/2017	11:54:28	8.65	25.5
5m from rd	13/12/2017	11:54:42	9.04	25.5

Table AI.1 Results of Vibration Monitoring at 85 Centralnaya Street, Petrovka

Address	Date	Time	Vibra 3532 Z [mm/s]	Dom. Freq. Z [Hz]
No 393	13/12/2017	14:23:34	8.13	18.5
high vib	13/12/2017	14:24:38	10.42	20.5
on wall	13/12/2017	14:25:38	9.44	23
low vib	13/12/2017	14:27:14	4.92	25.5
on wall	13/12/2017	14:27:56	5.06	25.5
	13/12/2017	14:28:58	4.66	26
high vib	13/12/2017	14:30:54	12.41	24.5
on ground by wall	13/12/2017	14:30:56	11.09	24.5
18m from rd	13/12/2017	14:31:26	11.21	23.5
	13/12/2017	14:33:54	0	0.5
low vib	13/12/2017	14:34:10	6.97	24.5
9m from road	13/12/2017	14:34:32	5.27	25
	13/12/2017	14:34:58	7.62	25.5
low vib	13/12/2017	14:37:12	7.31	25.5
5m from rd	13/12/2017	14:37:48	7.31	25.5
	13/12/2017	14:38:44	7.51	25.5

Table AI.2 Results of Vibration Monitoring at 393 Centralnaya Street, Petrovka

Address	Date	Time	Vibra 3532 Z [mm/s]	Dom. Freq. Z [Hz]	Time	Vibra 3311 Z [mm/s]	Dom. Freq. Z [Hz]
No 268	14/12/2017	10:11:10	10.49	34.5	10:11:10	7.82	17.5
high vib	14/12/2017	10:11:12	10.41	34.5	10:11:12	7.44	17.5
35 at foundation							
low vibration	14/12/2017	10:25:10	5.64	19.5	10:25:10	5.46	20
35 at foundation	14/12/2017	10:25:46	5.28	25	10:25:46	7.83	25
	14/12/2017	10:26:16	5.73	25	10:26:16	7.59	25
high vib	14/12/2017	10:30:28	14.66	22	10:30:28	5.45	21.5
35 at 5m	14/12/2017	10:31:22	13.98	24.5	10:31:22	5.71	24.5
	14/12/2017	10:31:52	12.35	32	10:31:52	4.13	32
low vibration	14/12/2017	10:34:18	14.78	25	10:34:18	5.52	25
35 at 5m	14/12/2017	10:34:54	15.94	25.5	10:34:54	6.1	25.5
	14/12/2017	10:35:14	15.32	25.5	10:35:14	5.9	25.5

Table AI.3 Results of Vibration Monitoring at 268 Centralnaya Street, Petrovka

Address	Date	Time	Vibra 3532 Z [mm/s]	Dom. Freq. Z [Hz]	Time	Vibra 3311 Z [mm/s]	Dom. Freq. Z [Hz]
No 122	14/12/2017	15:00:42	8.71	27.5	15:00:42	3.77	28
high vib	14/12/2017	15:00:58	9.2	31.5	15:00:58	3.41	31.5
both at foundation	14/12/2017	15:01:16	9.82	32	15:01:16	2.93	32
low	14/12/2017	15:02:22	4.09	25.5	15:02:22	1.67	25.5
both at foundation	14/12/2017	15:02:36	4.03	21.5	15:02:36	2.44	21.5
	14/12/2017	15:03:00	5.61	25.5	15:03:00	2.34	25.5
high vibration	14/12/2017	15:05:36	15.15	31.5	15:05:36	2.41	31.5
5m from rd	14/12/2017	15:06:04	12.82	32	15:06:04	2.8	32
	14/12/2017	15:06:24	13.38	32.5	15:06:24	2.38	32
					15:07:38	0.04	1
low vibration	14/12/2017	15:07:40	0.03	0.5	15:07:40	0.03	0.5
5m from rd	14/12/2017	15:07:42	0.03	0.5	15:07:42	0.03	0.5
	14/12/2017	15:08:04	10.93	25.5	15:08:04	1.2	25.5
	14/12/2017	15:08:46	11.86	25.5	15:08:46	1.23	25.5
	14/12/2017	15:09:10	11.72	25.5	15:09:10	1.04	25.5

Table AI.4 Results of Vibration Monitoring at 122 Centralnaya Street, Petrovka

Address	Date	Time	Vibra 3532 Z [mm/s]	Dom. Freq. Z [Hz]	Time	Vibra 3311 Z [mm/s]	Dom. Freq. Z [Hz]
No 214	14/12/2017	11:23:42	4.67	19.5	11:23:42	5.03	19.5
high vib	14/12/2017	11:24:12	6.37	32	11:24:12	4.67	32
both at wall	14/12/2017	11:24:32	4.02	32	11:24:32	3.29	31.5
low vibration	14/12/2017	11:26:30	6.65	25	11:26:30	5.01	25
both at wall	14/12/2017	11:26:46	5.77	26	11:26:46	4.45	26
	14/12/2017	11:27:24	6.49	24.5	11:27:24	4.84	25
no vibration	14/12/2017	11:29:16	0.49	27.5	11:29:14	0.21	18.5
both at wall	14/12/2017	11:29:18	1.32	27.5	11:29:16	0.38	21
10m	14/12/2017	11:29:20	0.24	25.5	11:29:18	0.98	21.5
	14/12/2017	11:29:22	0.54	26.5	11:29:20	0.2	21.5
	14/12/2017	11:29:24	0.28	26.5	11:29:22	0.43	26.5
	14/12/2017	11:29:26	0.46	27	11:29:24	0.17	26.5
	14/12/2017	11:29:28	0.76	20	11:29:26	0.29	22
high vibration	14/12/2017	11:33:06	11.28	20.5	11:33:06	4.38	18
35 at 6m postion	14/12/2017	11:33:46	10.22	21.5	11:33:46	4.88	20.5
	14/12/2017	11:33:48	1.69	16.5	11:33:48	1.48	17
low vibration	14/12/2017	11:35:00	11.19	22.5	11:35:00	4.36	20
6m	14/12/2017	11:35:50	10.53	20	11:35:50	4.44	19.5
no vib	14/12/2017	11:37:50	0.03	0.5	11:37:50	0.03	1
6m position	14/12/2017	11:37:52	0.04	1	11:37:52	0.03	0.5
	14/12/2017	11:38:28	0.33	22.5	11:38:28	0.19	26.5
	14/12/2017	11:38:30	1.13	19.5	11:38:30	0.33	20
	14/12/2017	11:38:32	0.06	5	11:38:32	0.04	0.5
	14/12/2017	11:38:34	0.19	20	11:38:34	0.11	20
high vib	14/12/2017	11:47:32	13.25	22.5	11:47:32	4.46	24
3m position	14/12/2017	11:47:56	10.69	21.5	11:47:56	3.27	21.5
	14/12/2017	11:48:20	10.95	31.5	11:48:20	3.27	32
low at 3m	14/12/2017	11:50:00	11.63	26	11:50:00	3.89	26
	14/12/2017	11:50:26	11.76	25.5	11:50:26	3.44	25.5
	14/12/2017	11:50:52	11.76	26	11:50:52	3.91	25.5

Table AI.5 Results of Vibration Monitoring at 214 Centralnaya Street, Petrovka

		Vibra			Vibra	
		3523			3311	
Date	Time	Z [mm/s]	Z [Hz]	Time	Z [mm/s]	Z [Hz]
				11:55:30	0.02	0.5
12/12/2017	11:56:00	1.37	10.5	11:56:00	0.85	9.5
12/12/2017	11:56:30	2.23	16.5	11:56:30	1.14	10
12/12/2017	11:57:00	2.6	11	11:57:00	1.6	10.5
12/12/2017	11:57:30	2.36	11	11:57:30	1.59	11
12/12/2017	11:57:37	0.55	0.5	11:57:50	0.32	11

Table AI.6 Results of Vibration Monitoring of Excavator at 85 Centralnaya Street, Petrovka (Vibra 3523 at 7m from Road and Vibra 3311 on foundation)

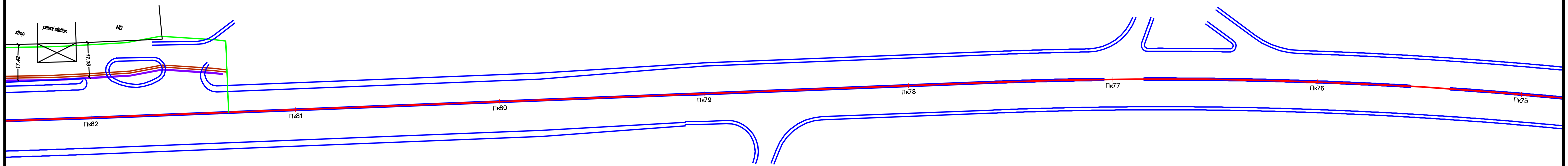
			3523	
Address	Date	Time	Z [mm/s]	Z [Hz]
No. 85	12/12/2017	12:32:00	0.29	14.5
3m	12/12/2017	12:32:30	0.38	19
	12/12/2017	12:33:00	0.66	10.5
	12/12/2017	12:33:30	0.55	20
	12/12/2017	12:33:47	0.18	2
5m	12/12/2017	11:42:00	0.37	19.5
	12/12/2017	11:42:30	0.39	1
	12/12/2017	11:43:00	0.34	12.5
	12/12/2017	11:43:30	0.83	13
	12/12/2017	11:44:00	0.61	18.5
	12/12/2017	11:44:04	0.25	15
14m	12/12/2017	11:08:30	0.13	12.5
nr	12/12/2017	11:09:00	0.11	12
foundation	12/12/2017	11:09:30	0.5	11.5
	12/12/2017	11:10:00	0.32	10
	12/12/2017	11:10:30	0.23	10
	12/12/2017	11:10:58	0.18	9.5
No. 214	14/12/2017	11:38:28	0.33	22.5
6m	14/12/2017	11:38:30	1.13	19.5
	14/12/2017	11:38:32	0.06	5

Table AI.7 Results of Vibration Monitoring of Excavator at 85 and 214 Centralnaya Street, Petrovka with roller operating at no vibration

APPENDIX IV.

CONTOUR MAP

Vibration Modeling Contours
(PK74+00~PK128+00)



without vibration, less than 16m

low vibration with trenches, more than 16m

high vibration with trenches, more than 32m

trench (approximate plotting)

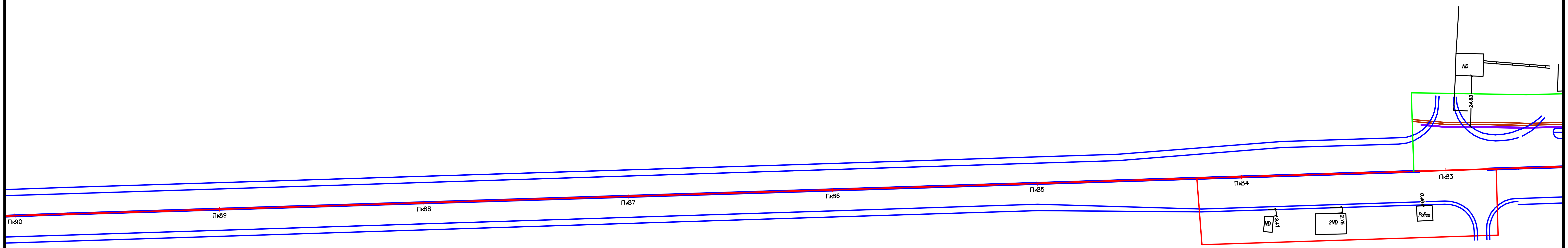
BH – Brick house

AH – Adobe house

SBH – Slag block house

ND – Non dwelling building

Vibration Modeling Contours
(PK74+00~PK128+00)



without vibration, less than 16m

low vibration with trenches, more than 16m

high vibration with trenches, more than 32m

trench (approximate plotting)

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AH – Adobe house
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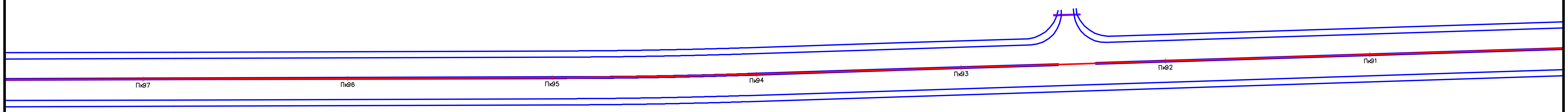
CAREC Carridor 3 (Bishkek-Osh Road) Improvement Project	China Railway No.5 Engineering Co. Ltd.	Plan of Risk-free Sub-sections in Section 3 (PK74+00-PK526+00)	design		approvel		date	

Vibration Modeling Contours
(PK74+00~PK128+00)



without vibration, less than 16m

low vibration with trenches, more than 16m

high vibration with trenches, more than 32m

trench (approximate plotting)

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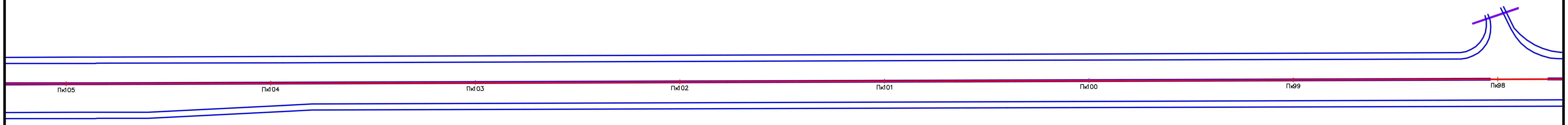
Vibration Modeling Contours
(PK74+00~PK128+00)



without vibration, less than 16m

low vibration with trenches, more than 16m

high vibration with trenches, more than 32m

trench (approximate plotting)

BH – Brick house

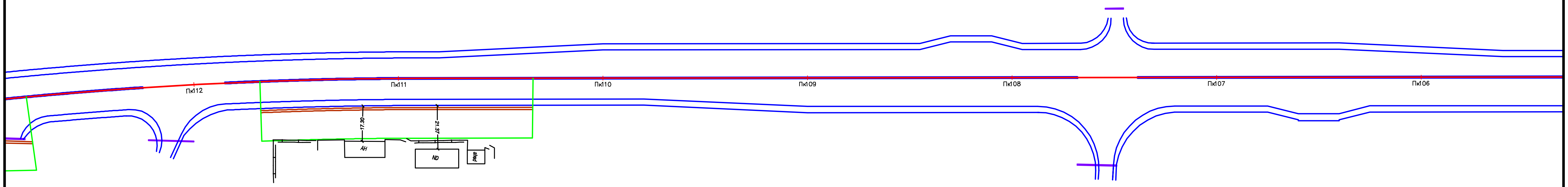
AH – Adobe house

SBH – Slag block house

ND – Non dwelling building

CAREC Carridor 3 (Bishkek-Osh Road) Improvement Project China Railway No.5 Engineering Co. Ltd.	Plan of Risk-free Sub-sections in Section 3 (PK74+00-PK526+00)	design		approvel		date	

Vibration Modeling Contours
(PK74+00~PK128+00)



without vibration, less than 16m

low vibration with trenches, more than 16m

high vibration with trenches, more than 32m

trench (approximate plotting)

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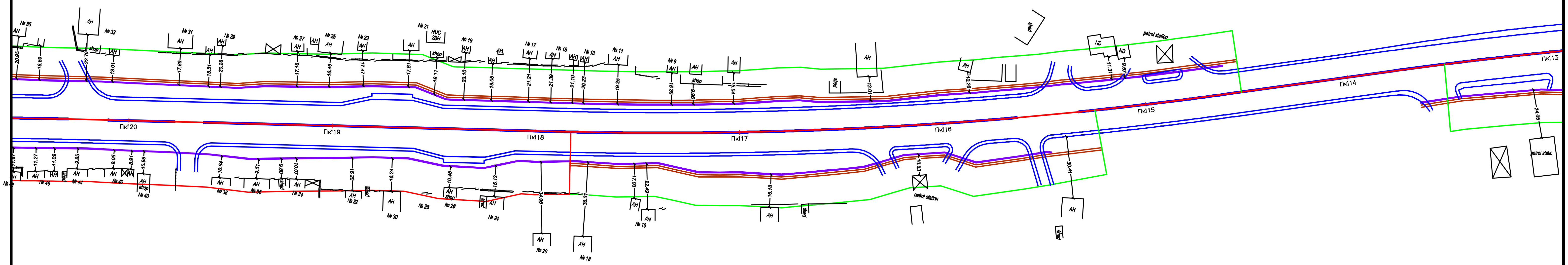
ND – Non dwelling building

CAREC Carridor 3 (Bishkek-Osh Road) Improvement Project	China Railway No.5 Engineering Co. Ltd.	Plan of Risk-free Sub-sections in Section 3 (PK74+00-PK526+00)	design		approvel		date		

Vibration Modeling Contours
(PK74+00~PK128+00)



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low vibration with trenches, more than 16m

high vibration with trenches, more than 32m

trench (approximate plotting)

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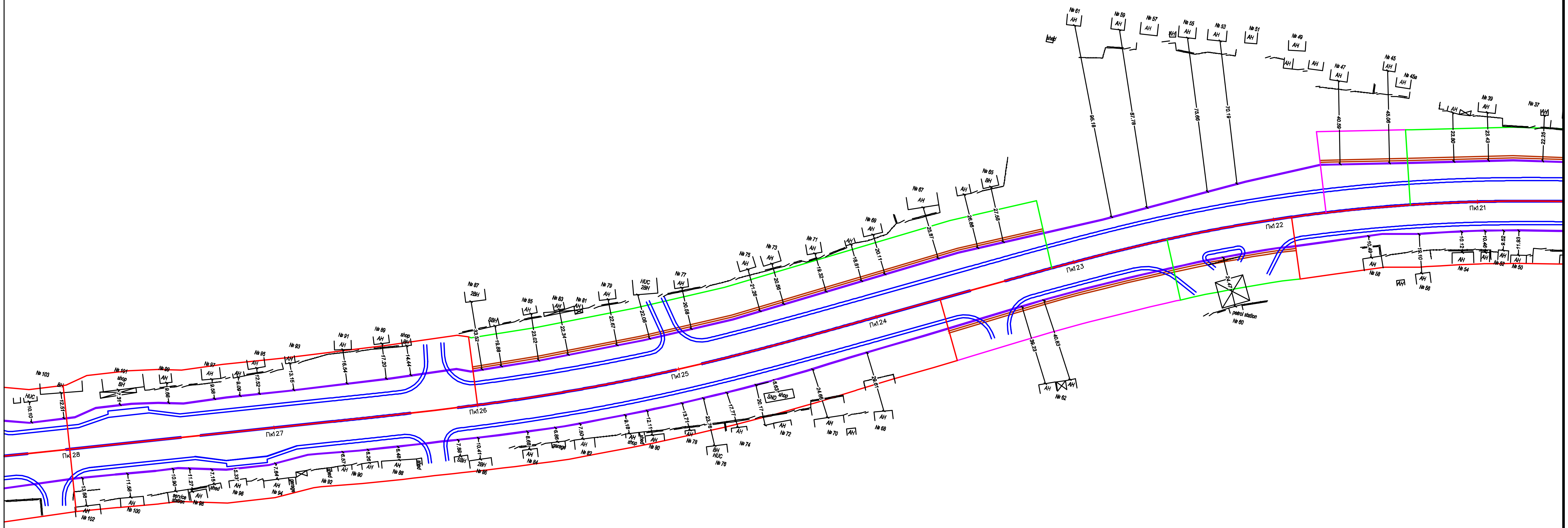
CAREC Carridor 3 (Bishkek-Osh Road) Improvement Project	China Railway No.5 Engineering Co. Ltd.	Plan of Risk-free Sub-sections in Section 3 (PK74+00-PK526+00)	design		approvel		date	

Vibration Modeling Contours
(PK74+00~PK128+00)



without vibration, less than 16m

low vibration with trenches, more than 16m

high vibration with trenches, more than 32m

trench (approximate plotting)

BH – Brick house

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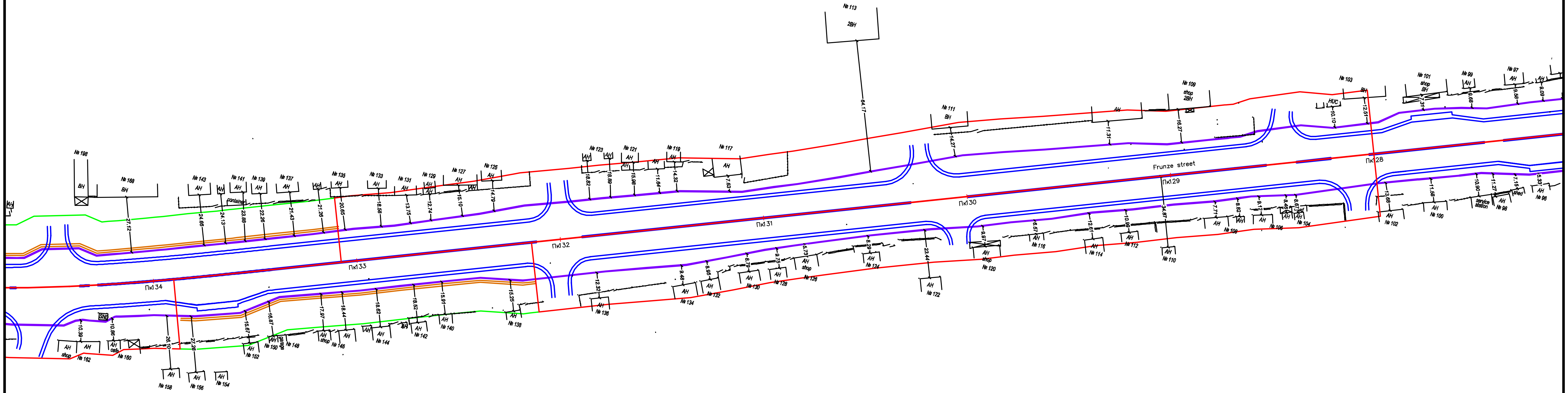
SBH – Slag block house

ND – Non dwelling building

Vibration Modeling Contours
(PK128+00~PK270+00)



without vibration, less than 16m

low vibration with trenches, more than 16m

high vibration with trenches, more than 32m

trench (approximate plotting)

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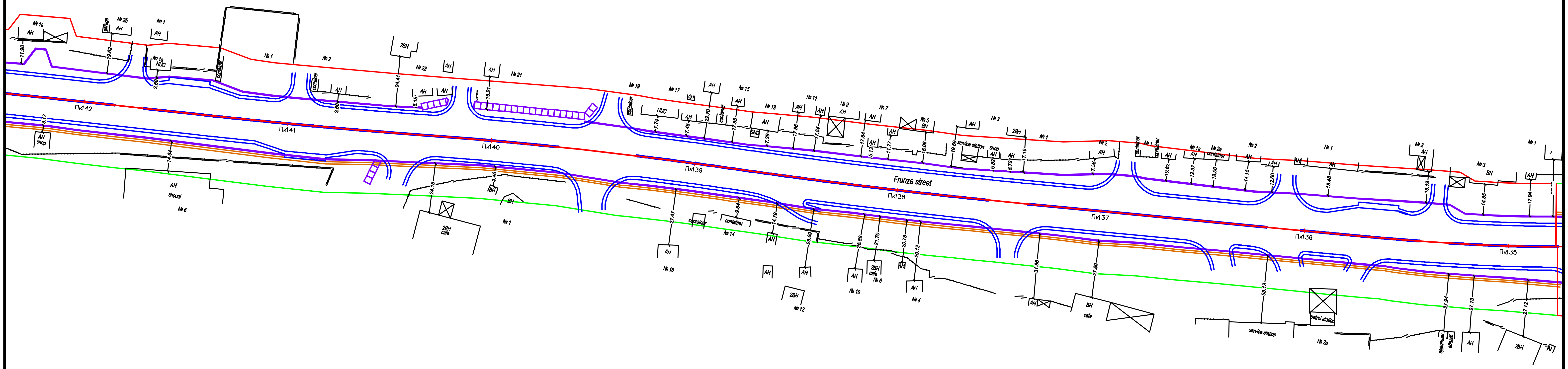
Vibration Modeling Contours
(PK128+00~PK270+00)



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high vibration with trenches, more than 32m

trench (approximate plotting)

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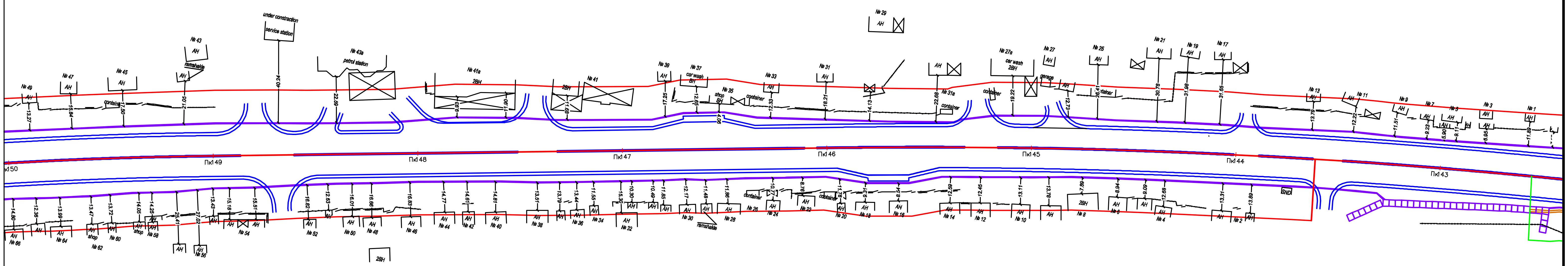
Vibration Modeling Contours
(PK128+00~PK270+00)



without vibration, less than 16m

low vibration with trenches, more than 16m

high vibration with trenches, more than 32m

trench (approximate plotting)

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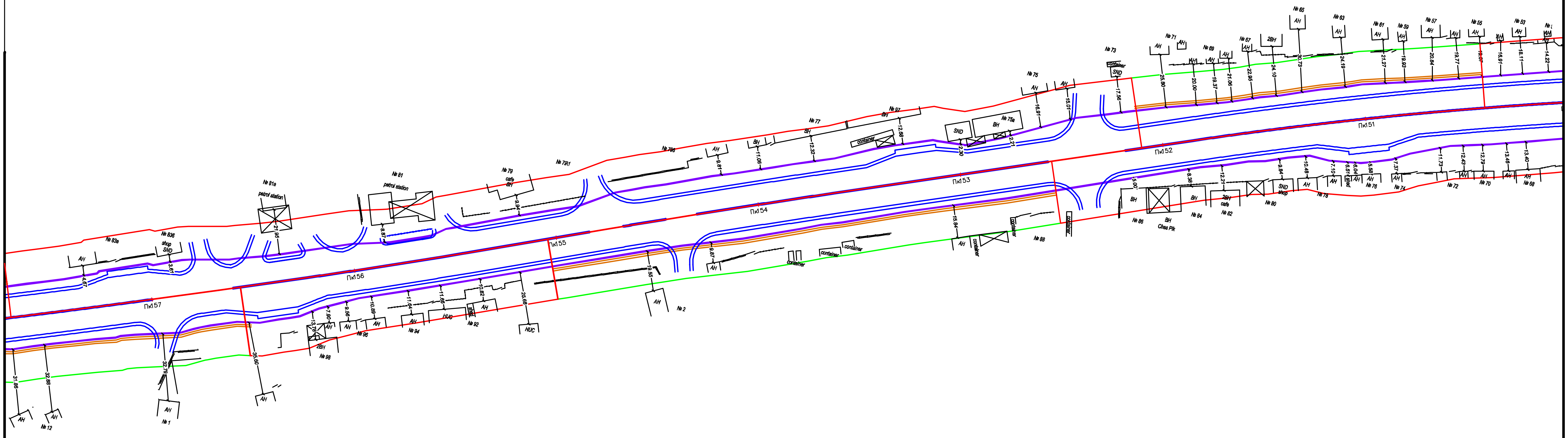
AH - Adobe house

SBH - Slag block house

ND - Non dwelling building

Vibration Modeling Contours
(PK128+00~PK270+00)



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low vibration with trenches, more than 16m

high vibration with trenches, more than 32m

trench (approximate plotting)

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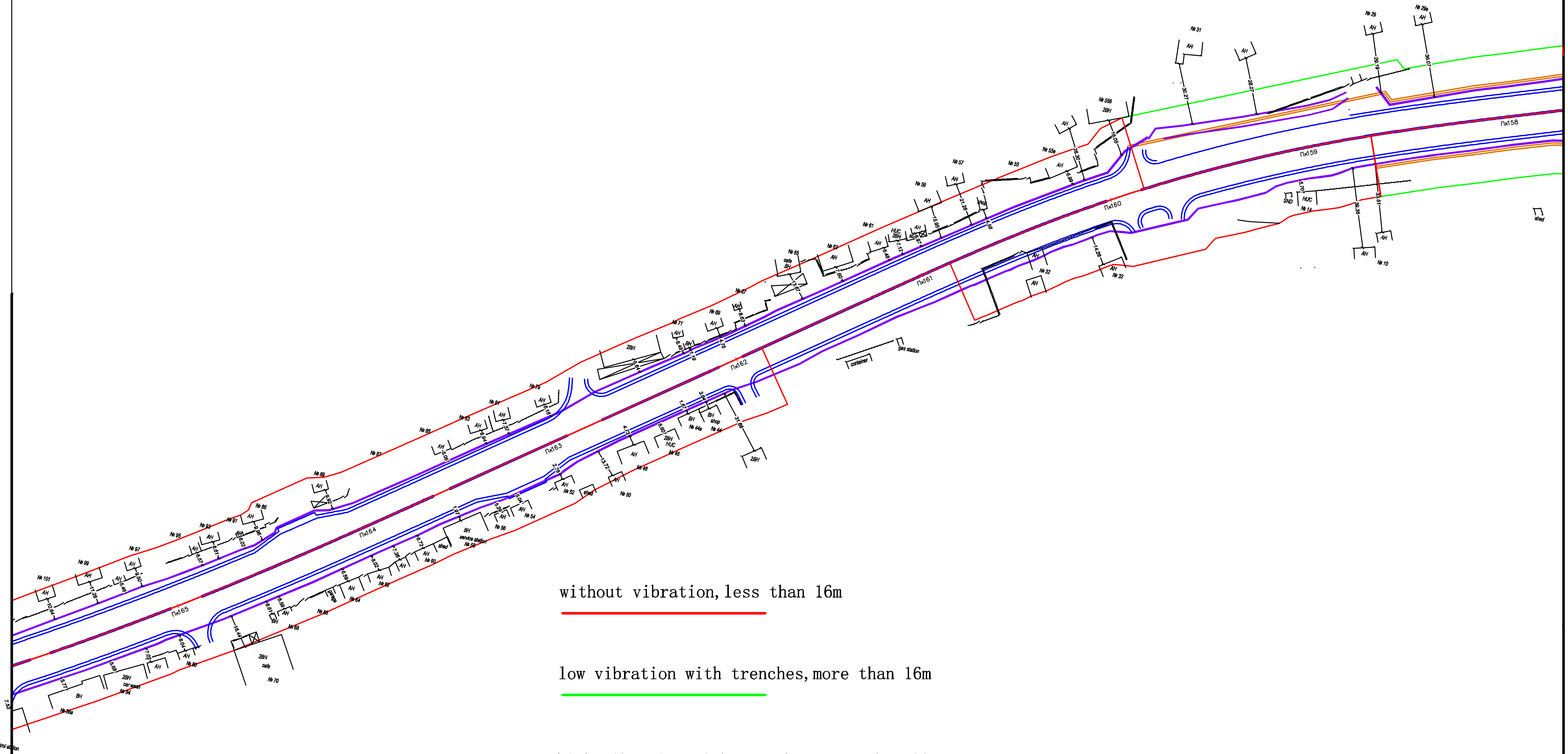
ND - Non dwelling building

CAREC Carridor 3 (Bishkek-Osh Road) Improvement Project	China Railway No.5 Engineering Co. Ltd.	Plan of Risk-free Sub-sections in Section 3 (PK74+00-PK526+00)	design		approvel		date

Vibration Modeling Contours
(PK128+00~PK270+00)



without vibration, less than 16m

low vibration with trenches, more than 16m

high vibration with trenches, more than 32m

trench (approximate plotting)

BH – Brick house

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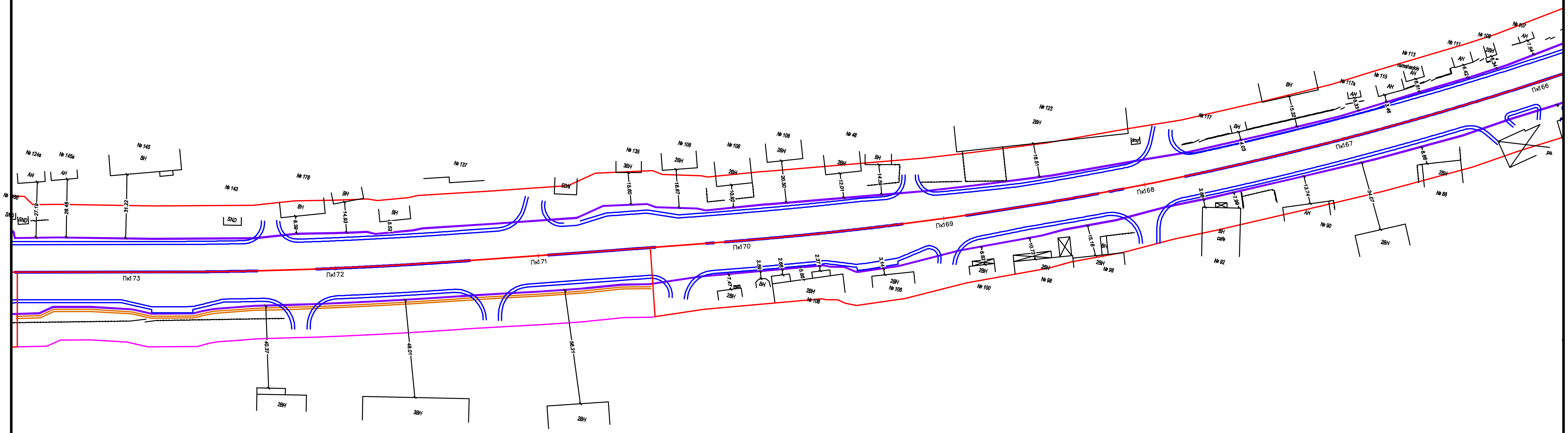
CAREC Carridor 3 (Bishkek-Osh Road) Improvement Project	China Railway No.5 Engineering Co. Ltd.	Plan of Risk-free Sub-sections in Section 3 (PK74+00-PK526+00)	design		approvel		date	

Vibration Modeling Contours
(PK128+00~PK270+00)



without vibration, less than 16m

low vibration with trenches, more than 16m

high vibration with trenches, more than 32m

trench (approximate plotting)

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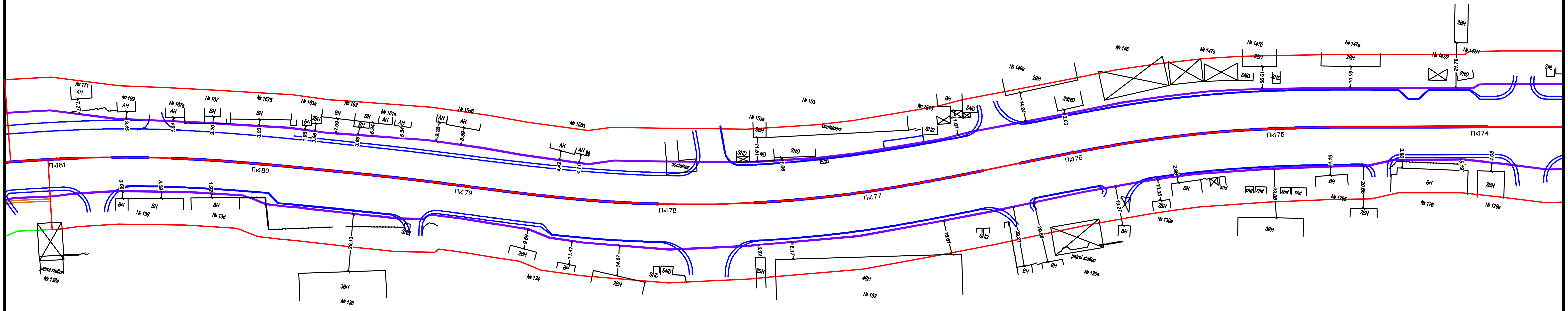
CAREC Carridor 3 (Bishkek-Osh Road) Improvement Project	China Railway No.5 Engineering Co. Ltd.	Plan of Risk-free Sub-sections in Section 3 (PK74+00-PK526+00)	design		approvel		date		

Vibration Modeling Contours
(PK128+00~PK270+00)



without vibration, less than 16m

low vibration with trenches, more than 16m

high vibration with trenches, more than 32m

trench (approximate plotting)

BH – Brick house
AH – Adobe house
SBH – Slag block house
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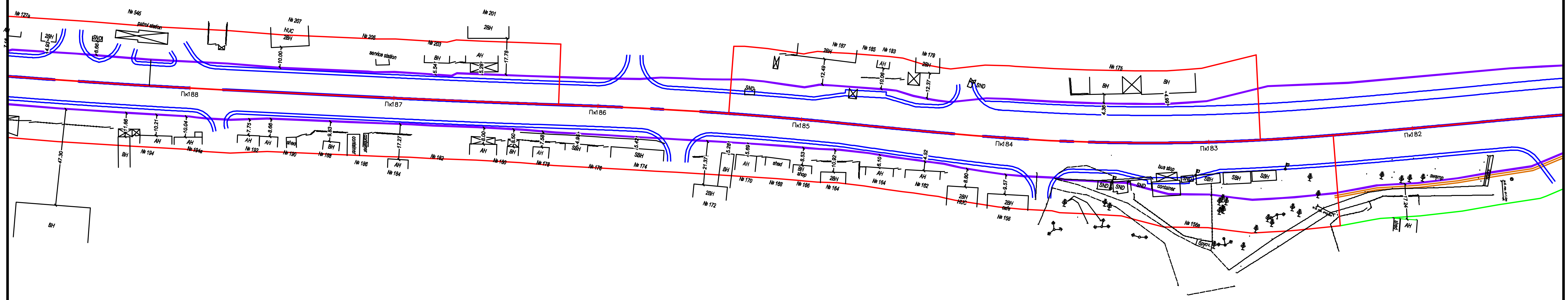
CAREC Carridor 3 (Bishkek-Osh Road) Improvement Project	China Railway No.5 Engineering Co. Ltd.	Plan of Risk-free Sub-sections in Section 3 (PK74+00-PK526+00)	design		approvel		date

Vibration Modeling Contours
(PK128+00~PK270+00)



without vibration,less than 16m

low vibration with trenches,more than 16m

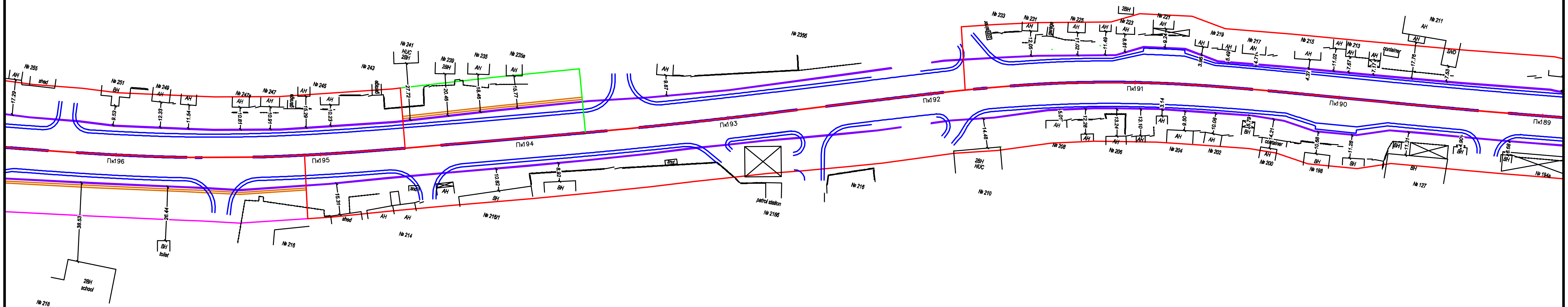
high vibration with trenches,more than 32m

trench (approximate plotting)

BH - Brick house
AH - Adobe house
SBH - Slag block house
ND - Non dwelling building

CAREC Carridor 3 (Bishkek-Osh Road) Improvement Project	China Railway No.5 Engineering Co. Ltd.	Plan of Risk-free Sub-sections in Section 3 (PK74+00-PK526+00)	design		approvel		date	

Vibration Modeling Contours
(PK128+00~PK270+00)



without vibration, less than 16m

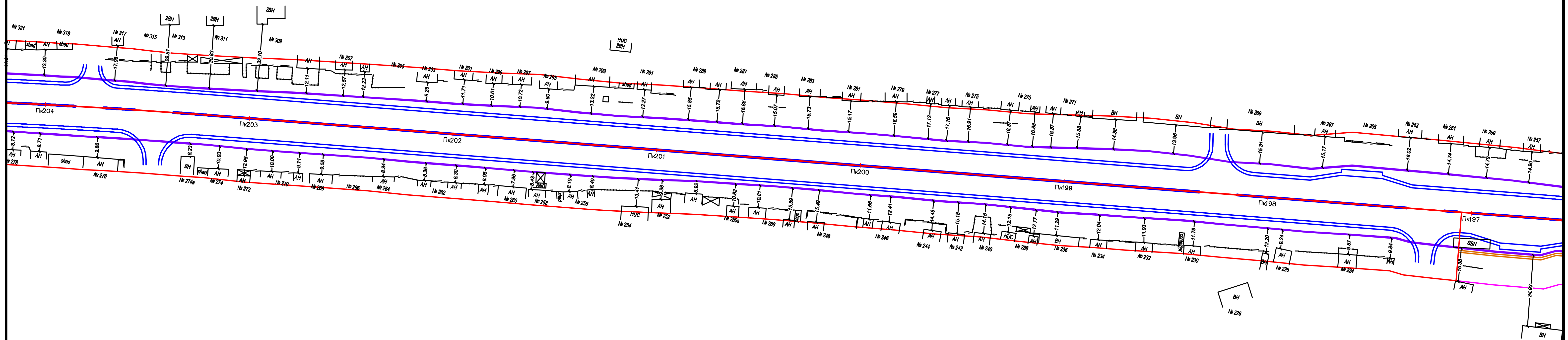
low vibration with trenches, more than 16m

high vibration with trenches, more than 32m

trench (approximate plotting)

BH - Brick house
AH - Adobe house
SBH - Slag block house
ND - Non dwelling building

Vibration Modeling Contours
(PK128+00~PK270+00)



without vibration, less than 16m

low vibration with trenches, more than 16m

high vibration with trenches, more than 32m

trench (approximate plotting)

BH - Brick house

AH - Adobe house

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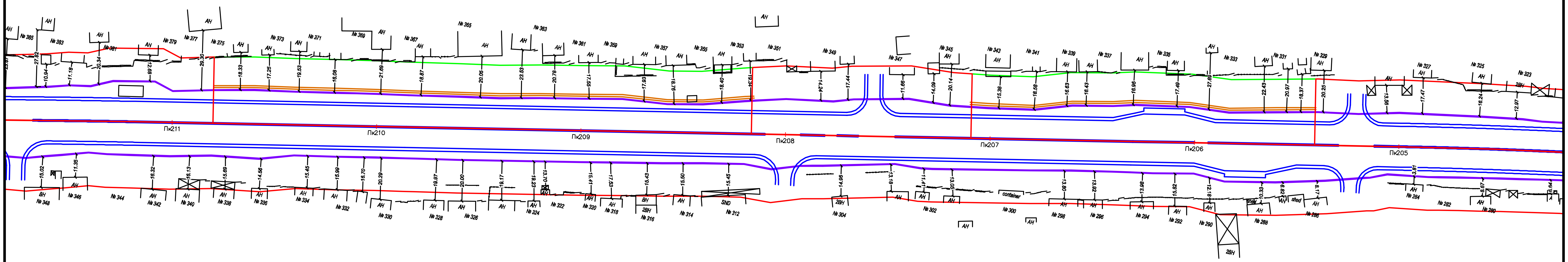
ND - Non dwelling building

CAREC Carridor 3 (Bishkek-Osh Road) Improvement Project	China Railway No.5 Engineering Co. Ltd.	Plan of Risk-free Sub-sections in Section 3 (PK74+00-PK526+00)	design		approvel		date		

Vibration Modeling Contours
(PK128+00~PK270+00)



without vibration, less than 16m

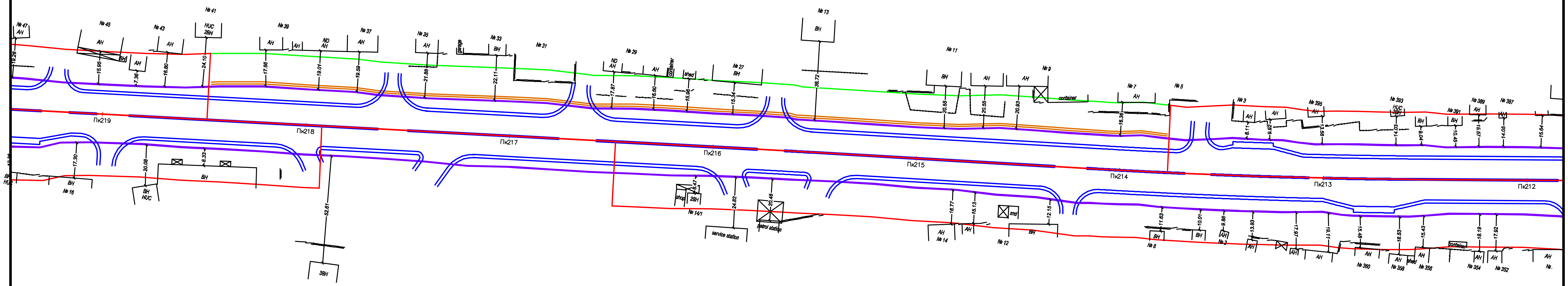
low vibration with trenches, more than 16m

high vibration with trenches, more than 32m

trench (approximate plotting)

BH – Brick house
AH – Adobe house
SBH – Slag block house
ND – Non dwelling building

Vibration Modeling Contours
(PK128+00~PK270+00)



without vibration, less than 16m

low vibration with trenches, more than 16m

high vibration with trenches, more than 32m

trench (approximate plotting)

BH – Brick house
AH – Adobe house
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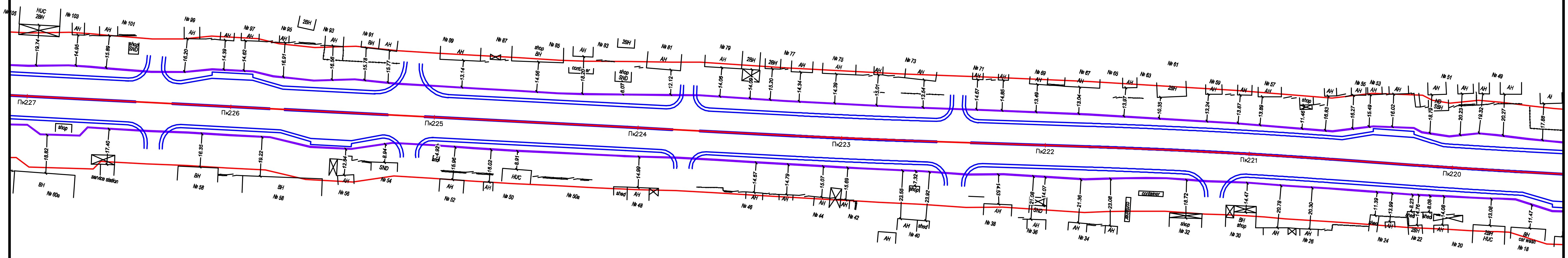
CAREC Carridor 3 (Bishkek-Osh Road) Improvement Project	China Railway No.5 Engineering Co. Ltd.	Plan of Risk-free Sub-sections in Section 3 (PK74+00-PK526+00)	design		approvel		date		

Vibration Modeling Contours
(PK128+00~PK270+00)



without vibration, less than 16m

low vibration with trenches, more than 16m

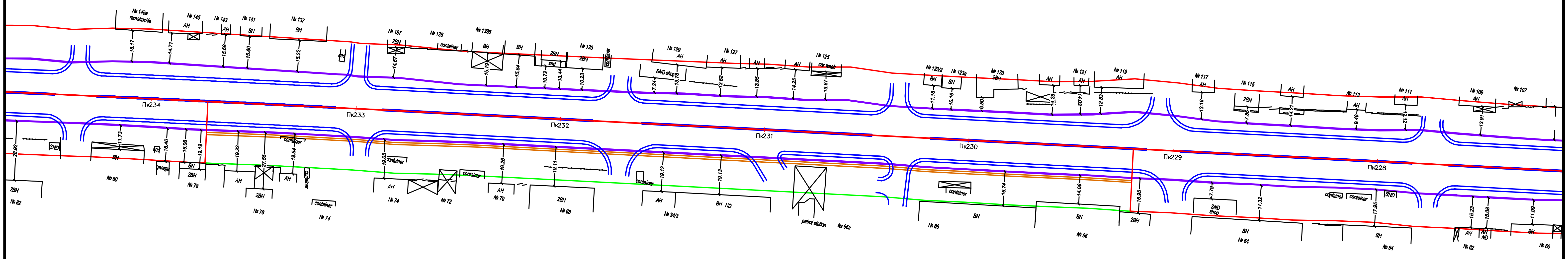
high vibration with trenches, more than 32m

trench (approximate plotting)

BH - Brick house
AH - Adobe house
SBH - Slag block house
ND - Non dwelling building

CAREC Carridor 3 (Bishkek-Osh Road) Improvement Project	China Railway No.5 Engineering Co. Ltd.	Plan of Risk-free Sub-sections in Section 3 (PK74+00-PK526+00)	design		approvel		date

Vibration Modeling Contours
(PK128+00~PK270+00)



without vibration, less than 16m

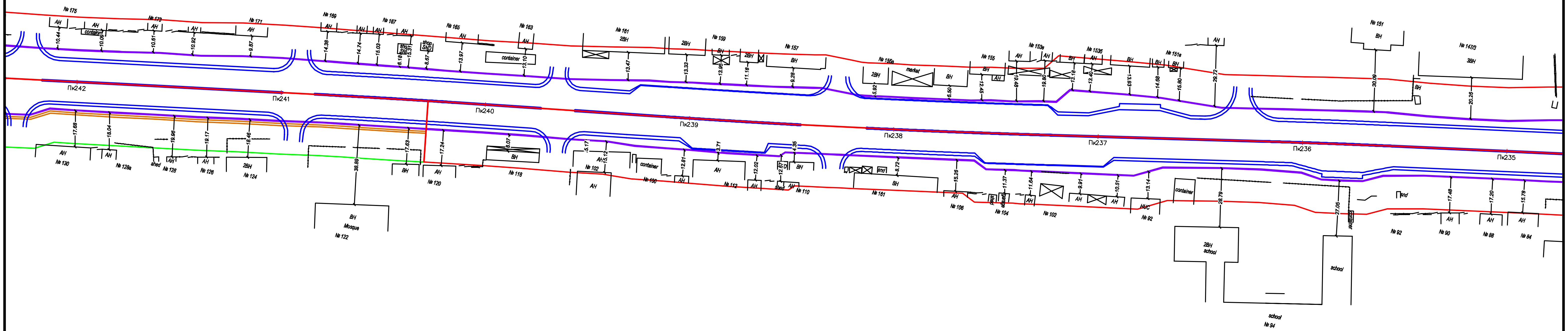
low vibration with trenches, more than 16m

high vibration with trenches, more than 32m

trench (approximate plotting)

BH - Brick house
AH - Adobe house
SBH - Slag block house
ND - Non dwelling building

Vibration Modeling Contours
(PK128+00~PK270+00)



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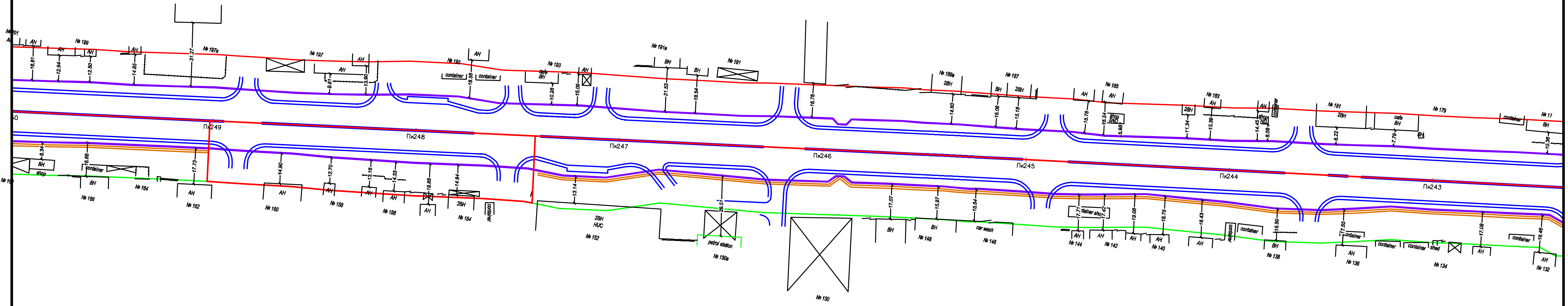
Vibration Modeling Contours
(PK128+00~PK270+00)



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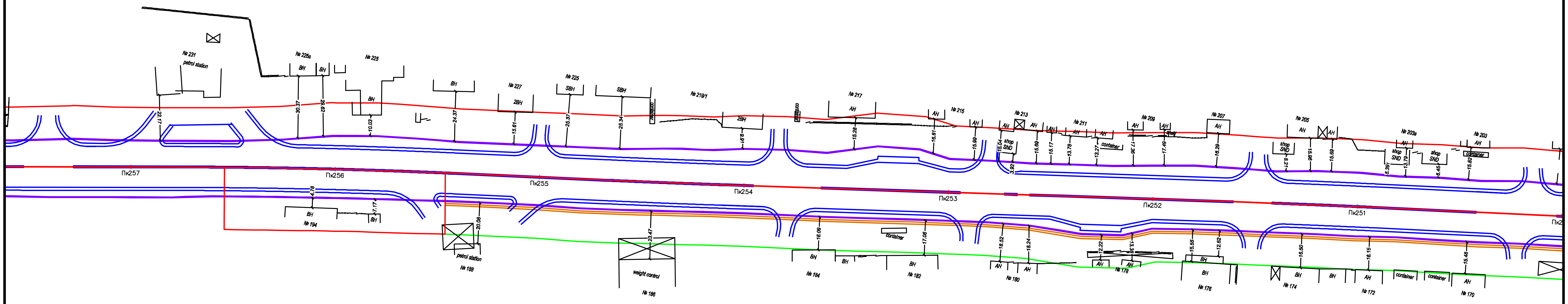
Vibration Modeling Contours
(PK128+00~PK270+00)



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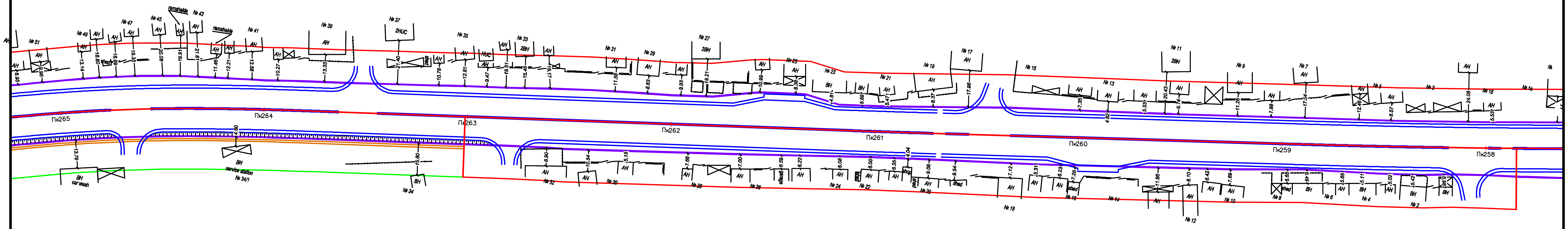

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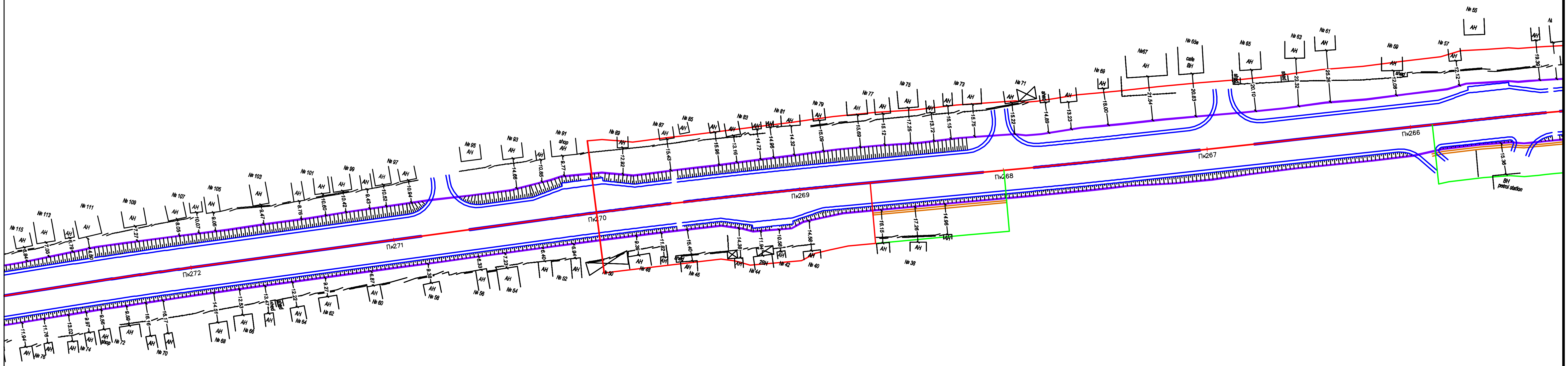

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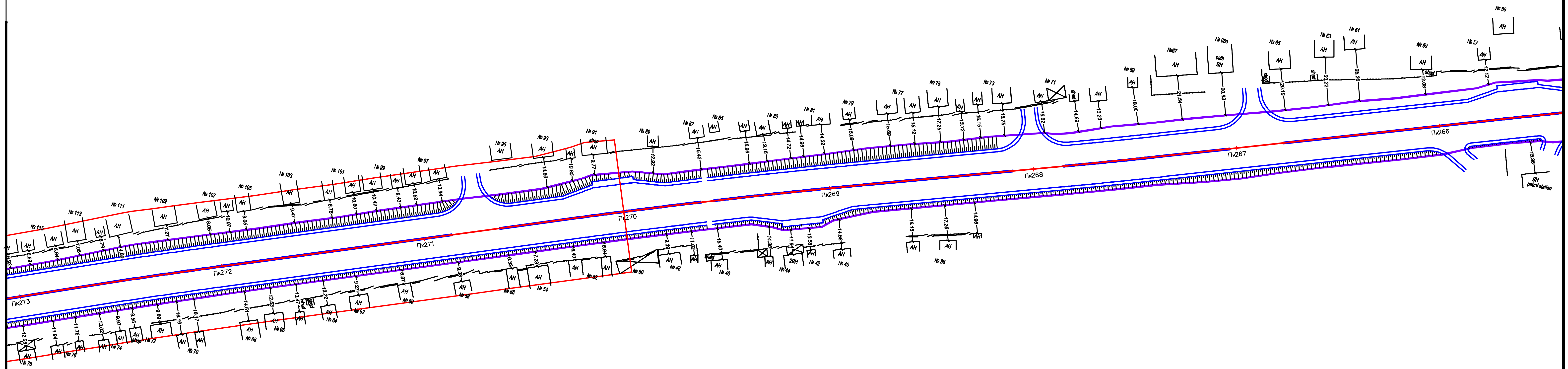
Vibration Modeling Contours
(PK270+00~PK320+80)



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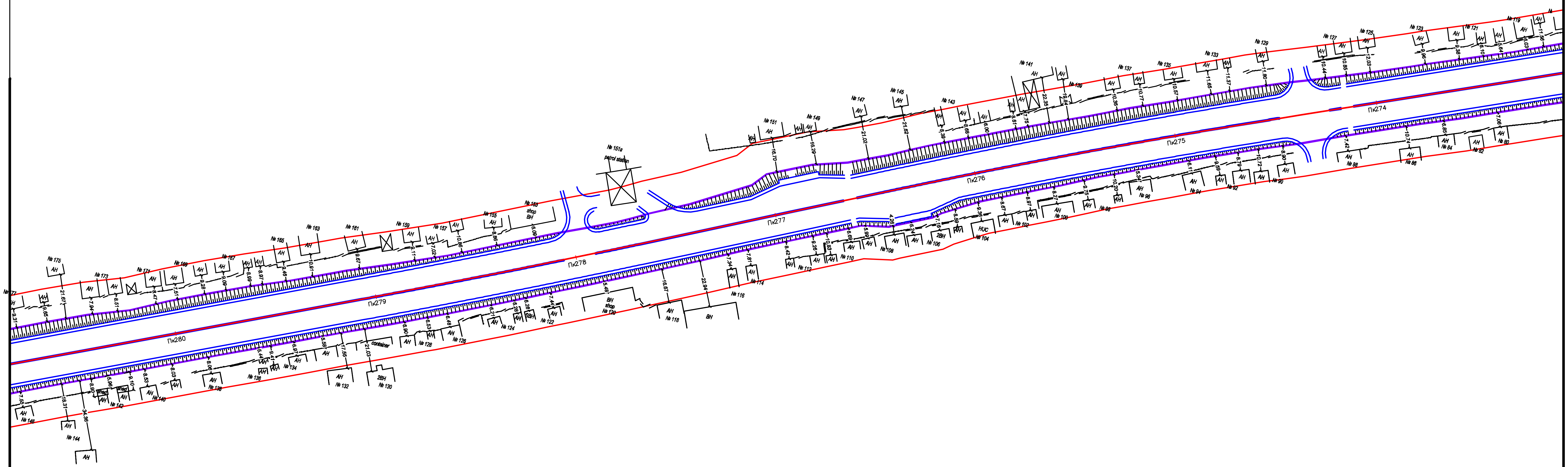
Vibration Modeling Contours
(PK270+00~PK320+80)



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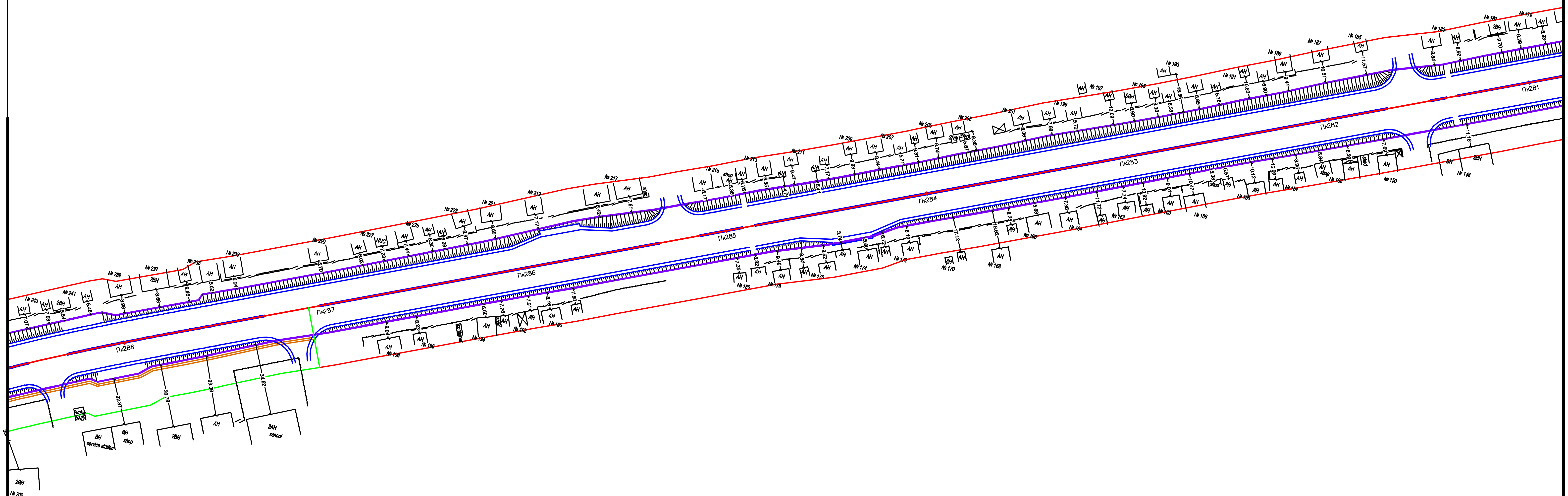

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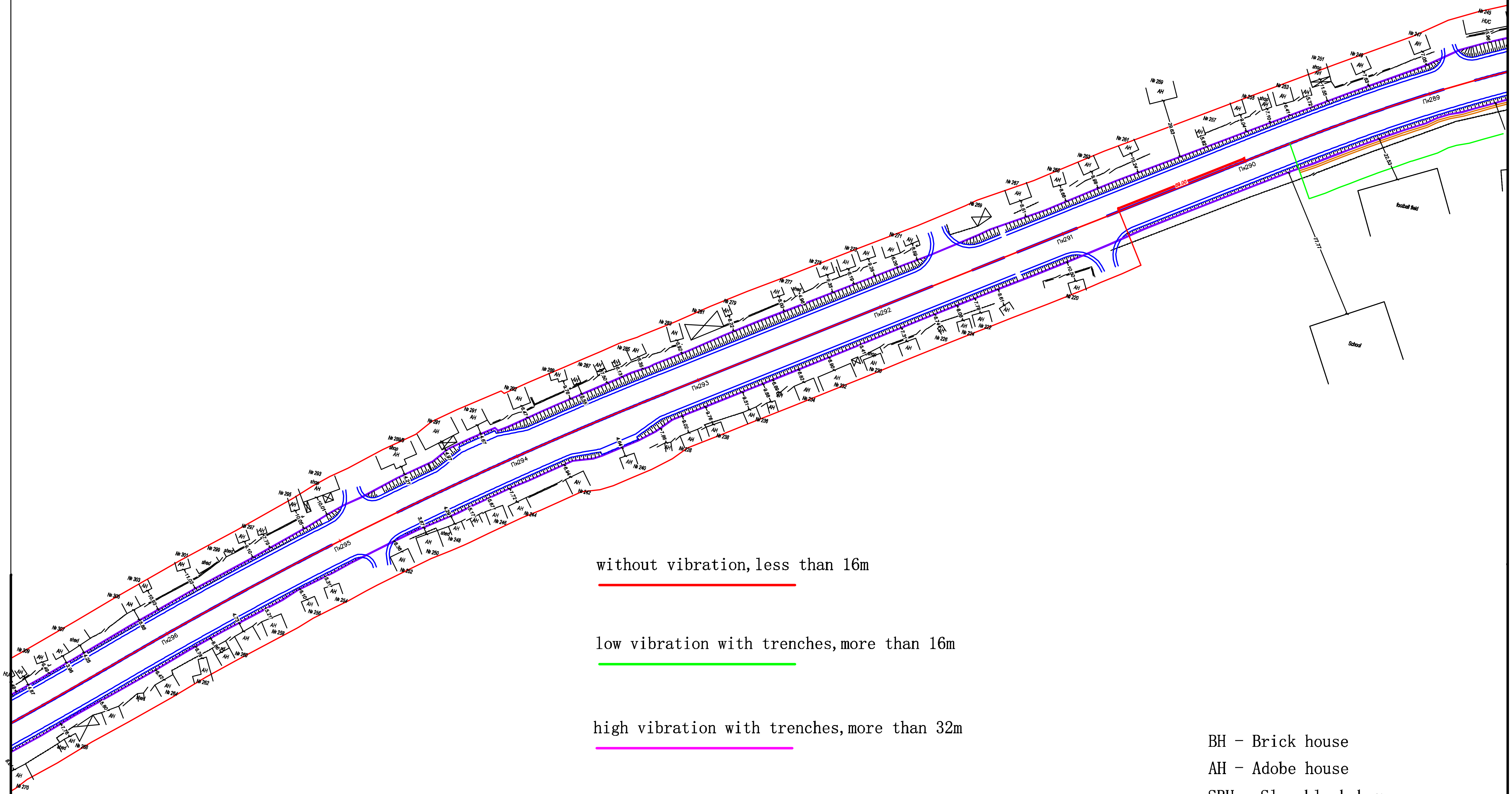

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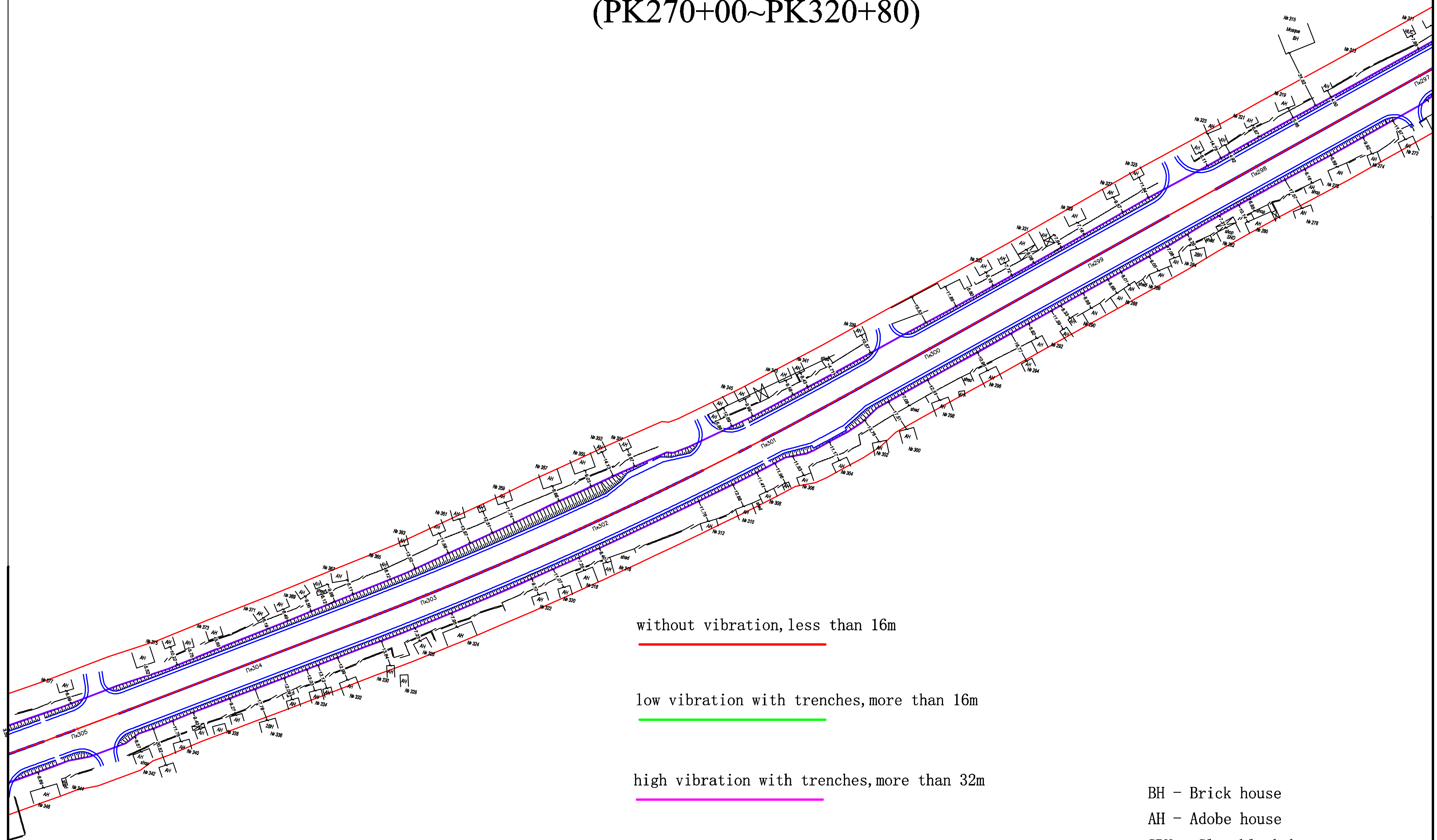

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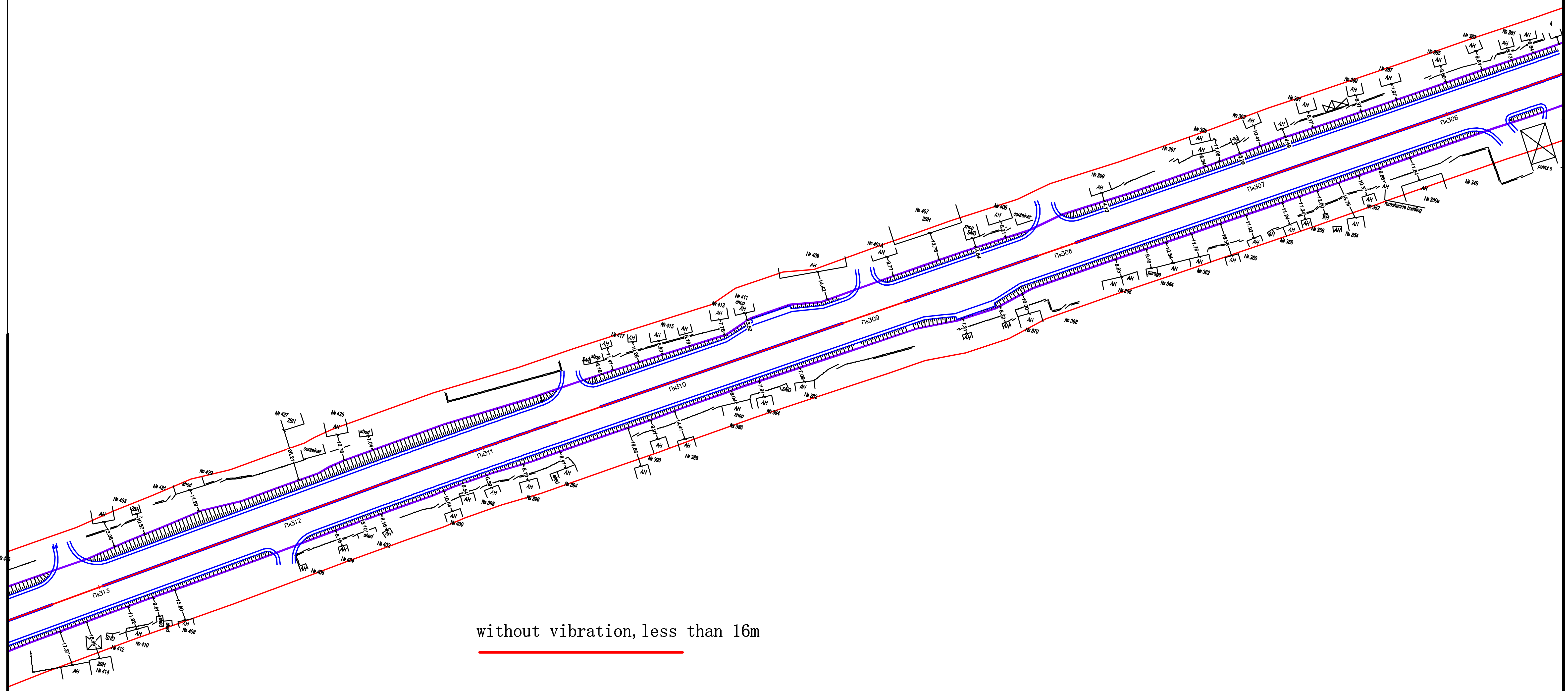

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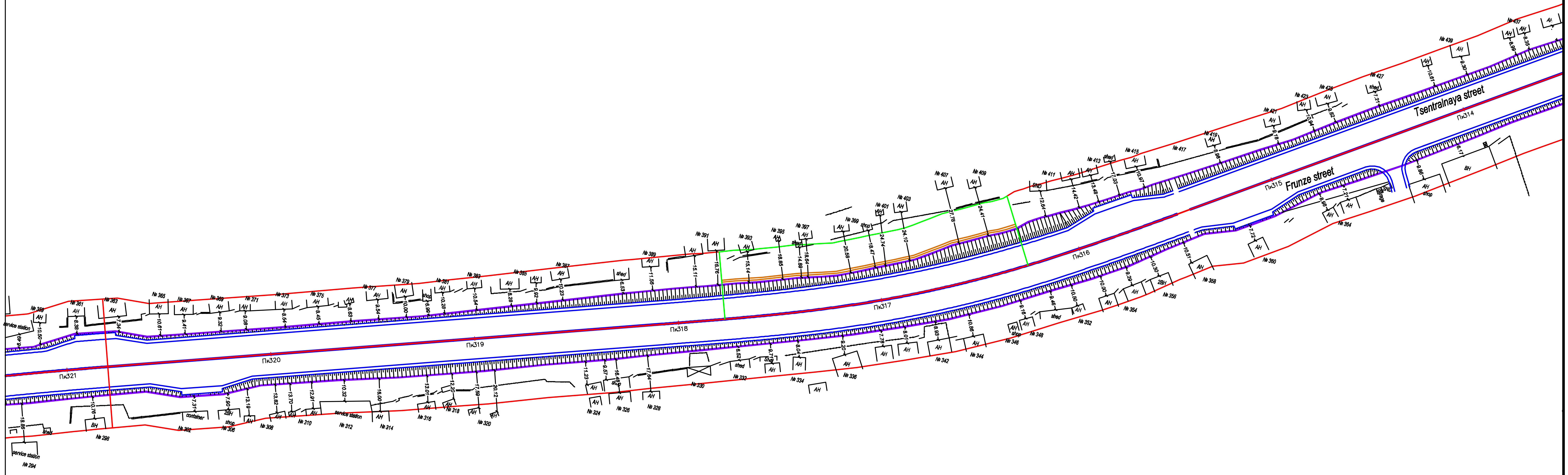

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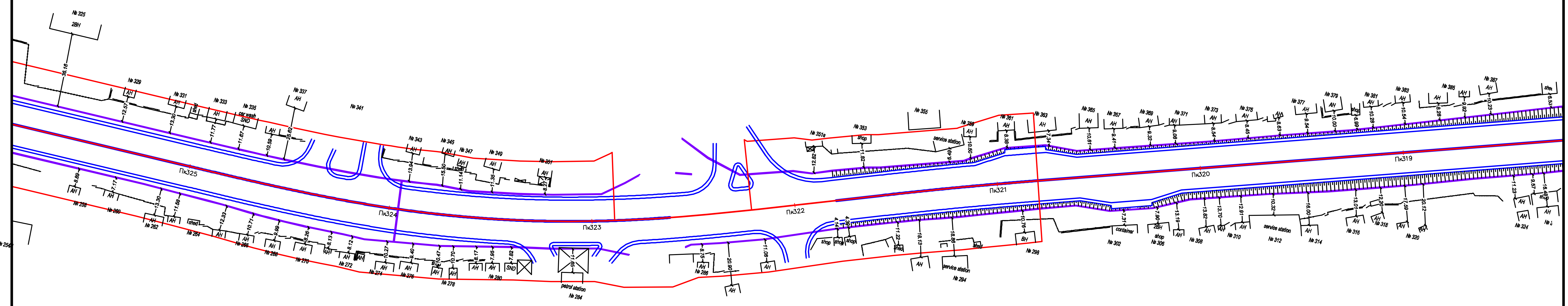
Vibration Modeling Contours
(PK320+80~PK371+00)



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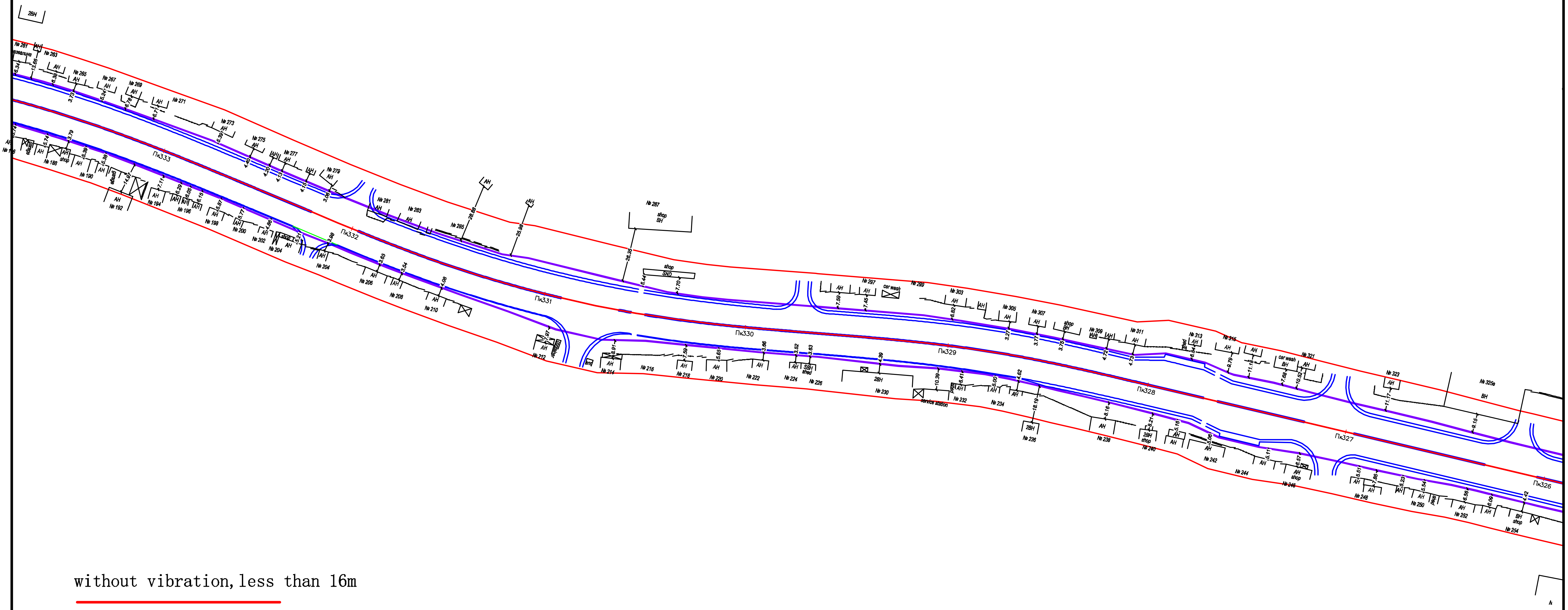
Vibration Modeling Contours
(PK320+80~PK371+00)



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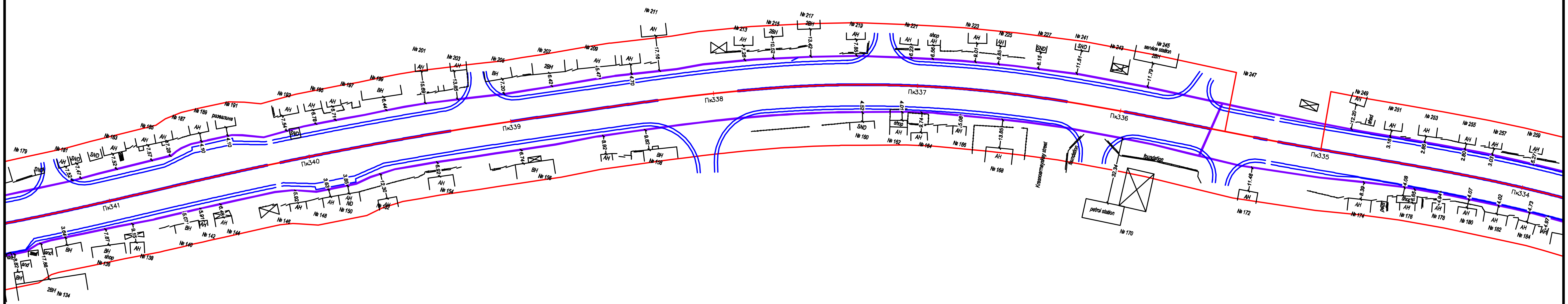

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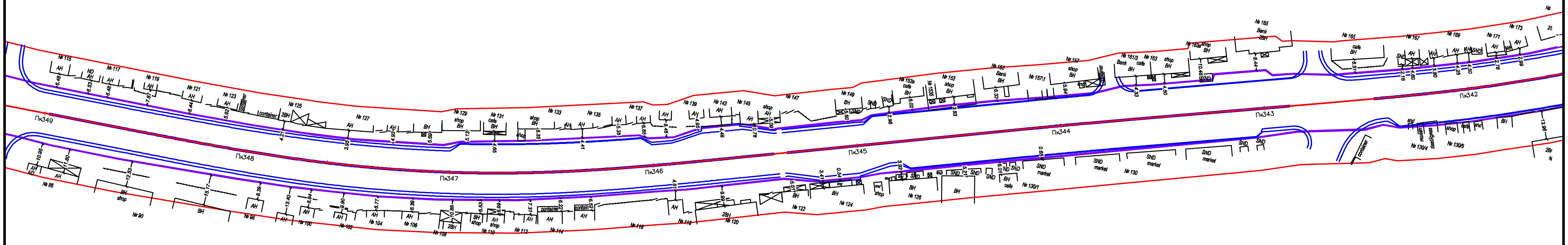

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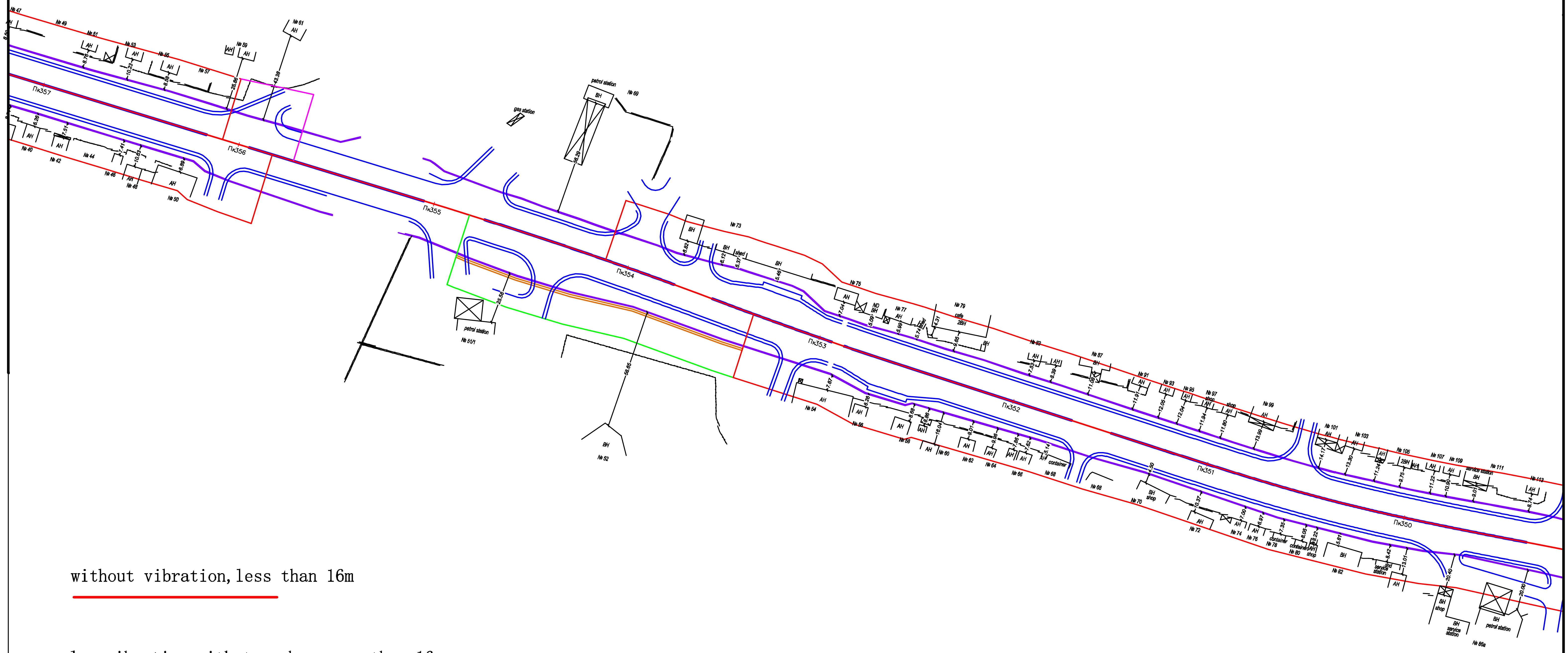

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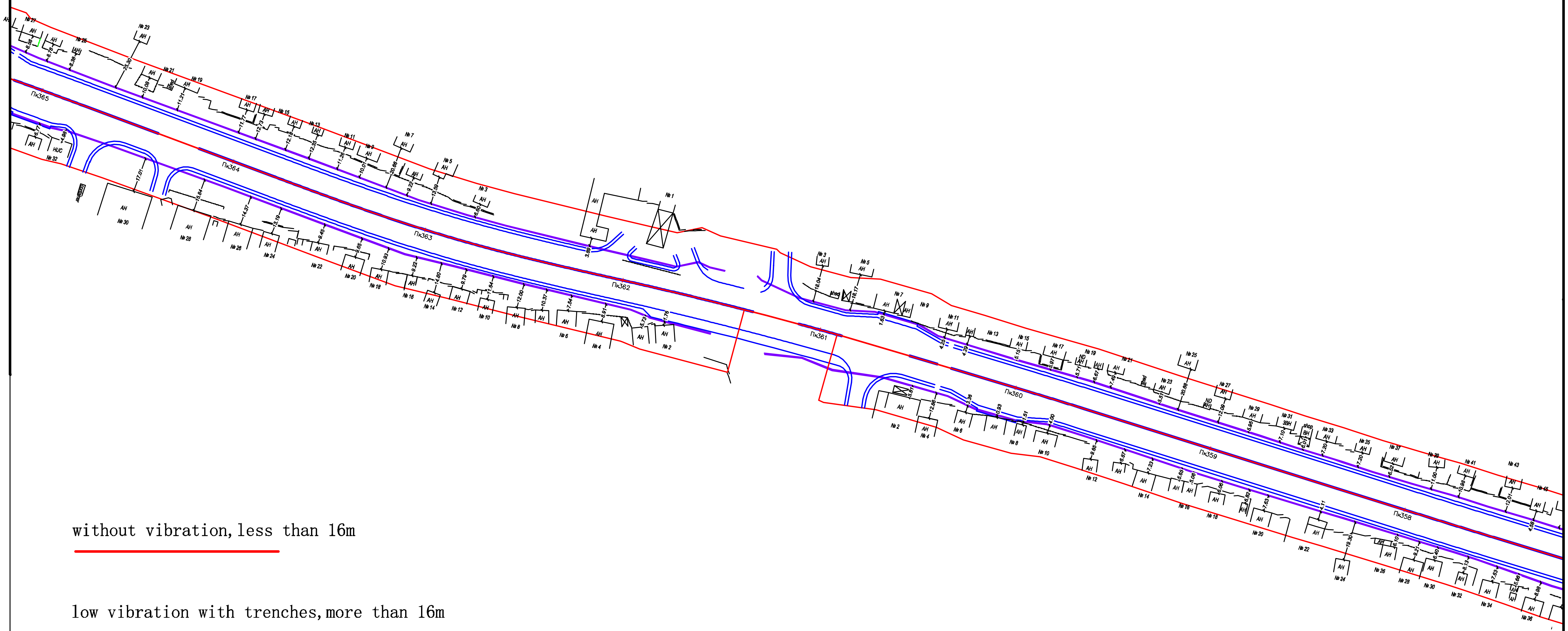

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Vibration Modeling Contours
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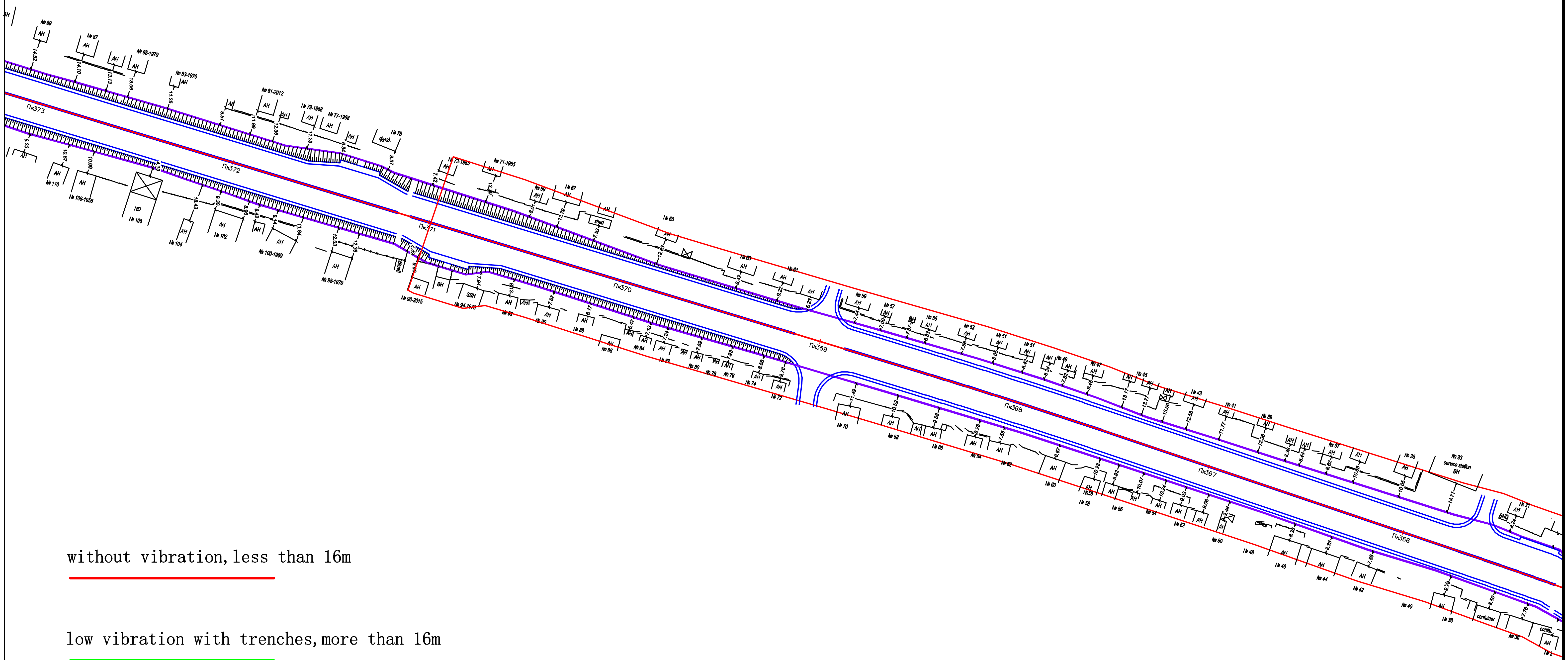

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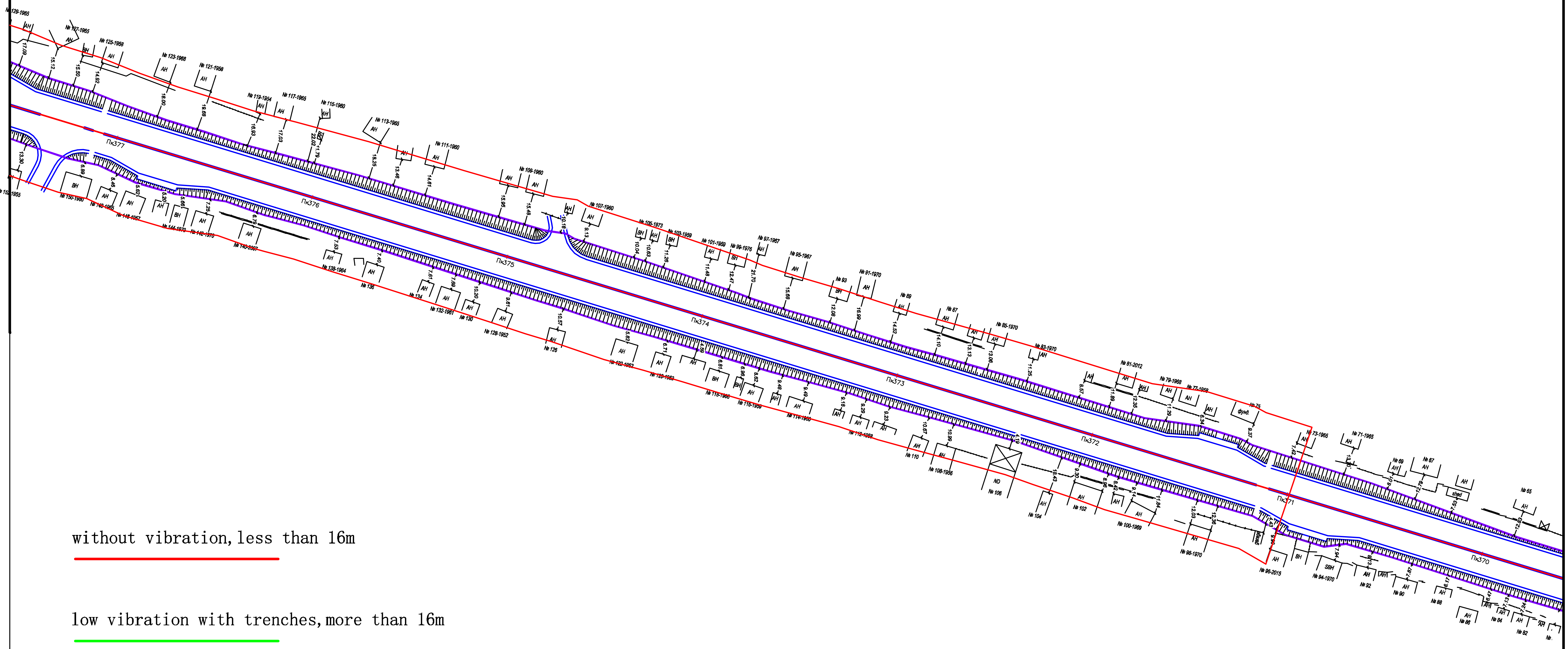
Vibration Modeling Contours
(PK371+00~PK431+00)



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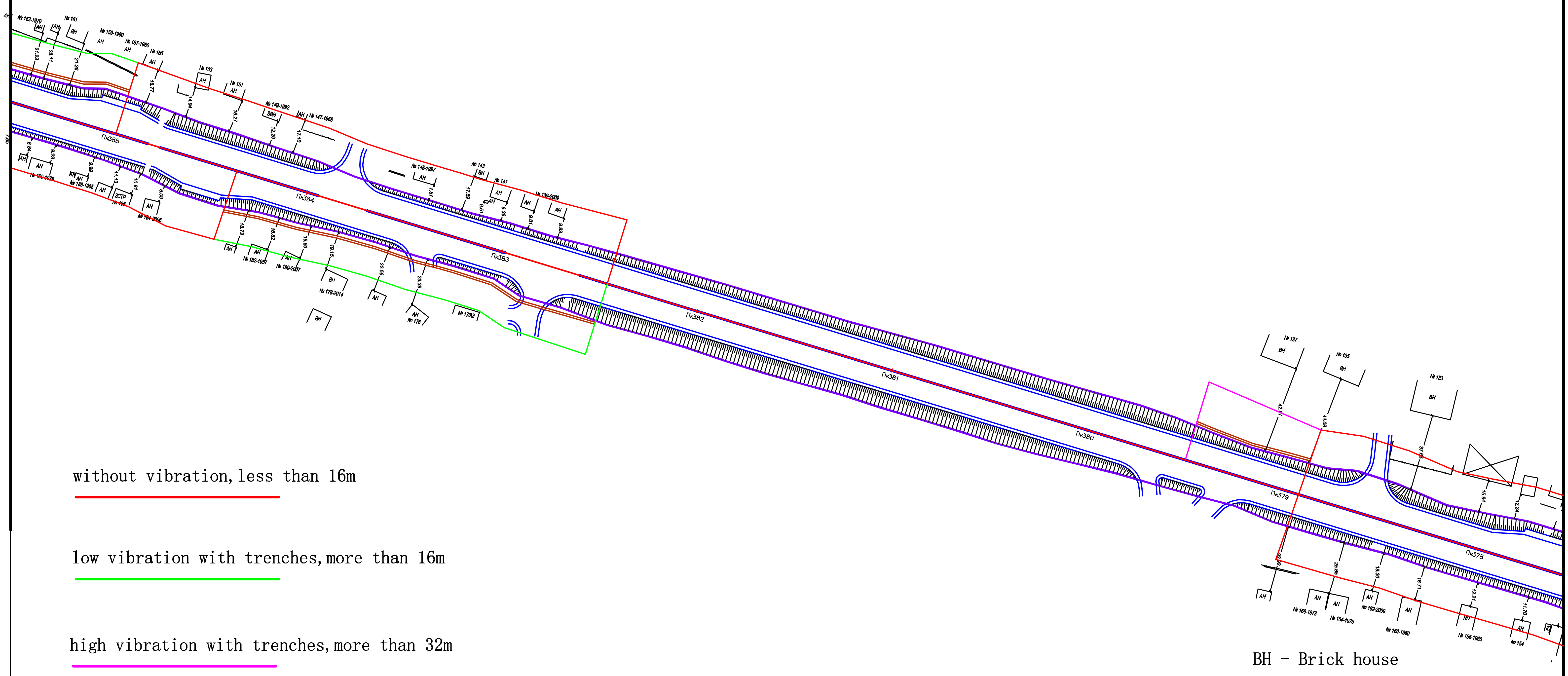
Vibration Modeling Contours
(PK371+00~PK431+00)



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Vibration Modeling Contours
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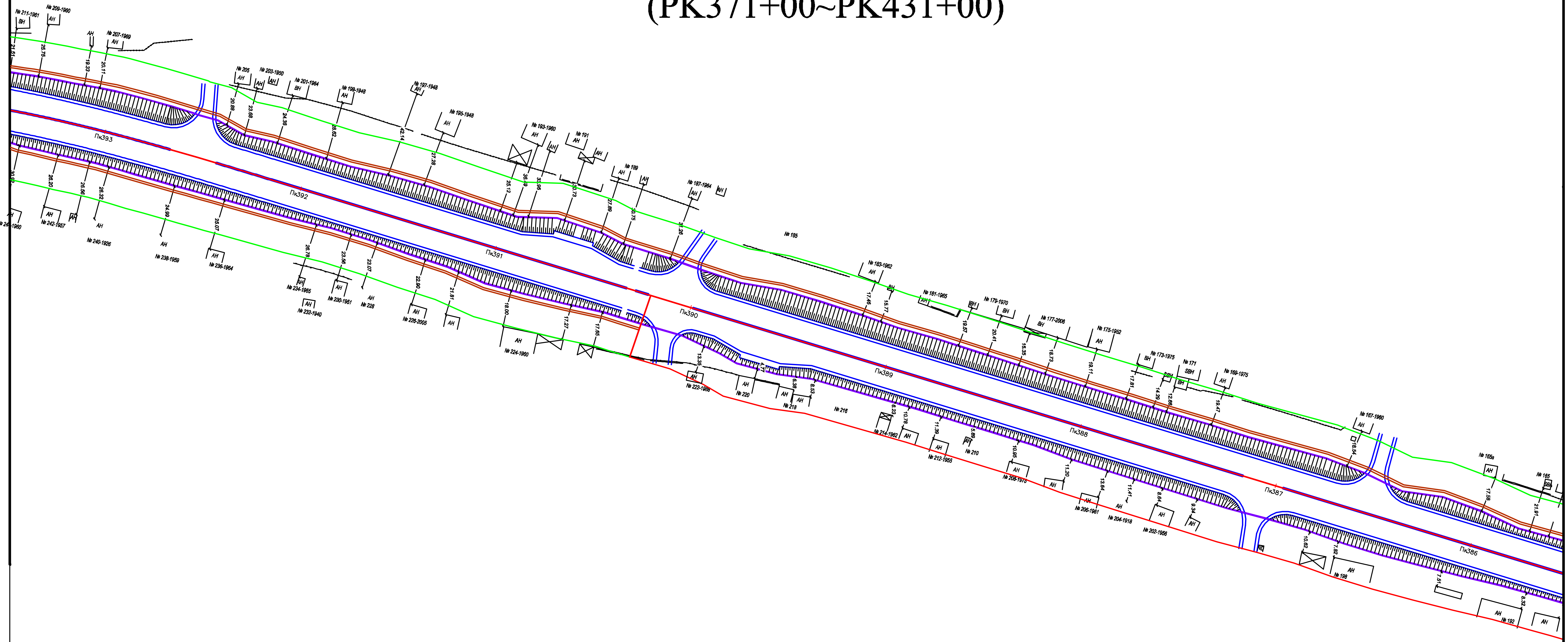

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Vibration Modeling Contours
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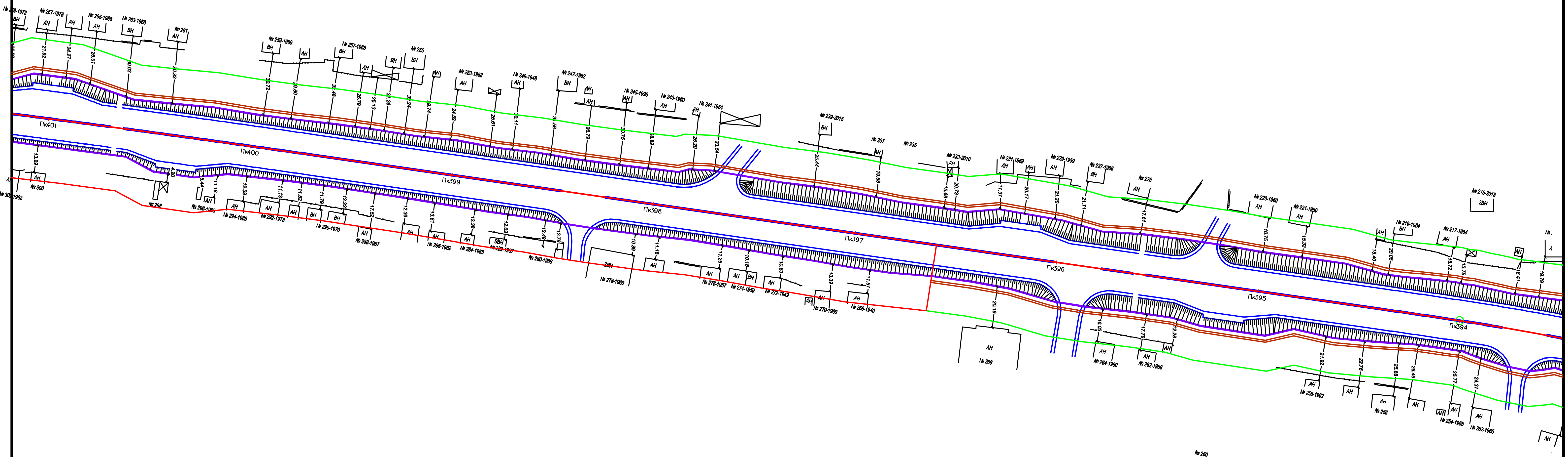

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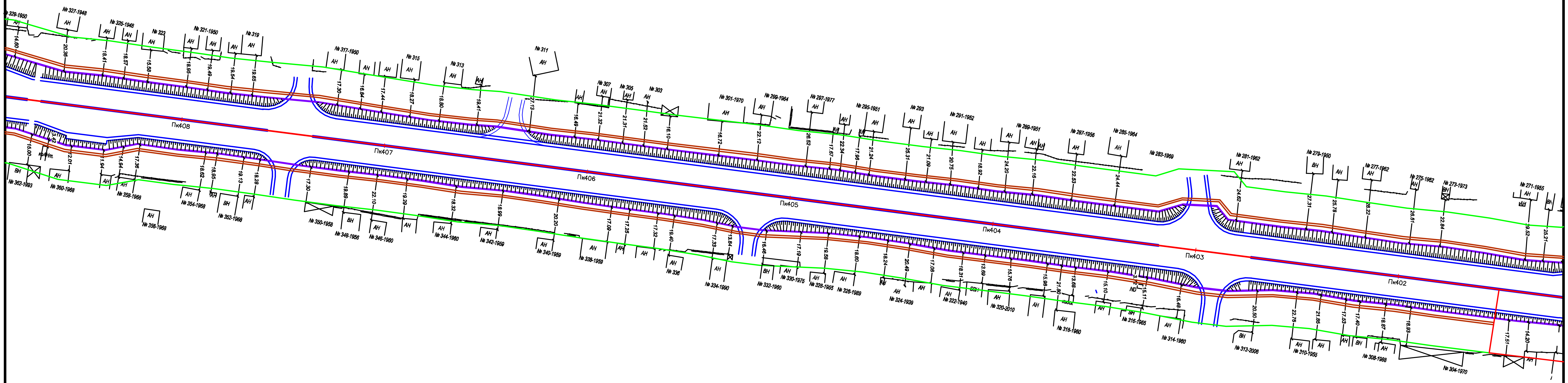

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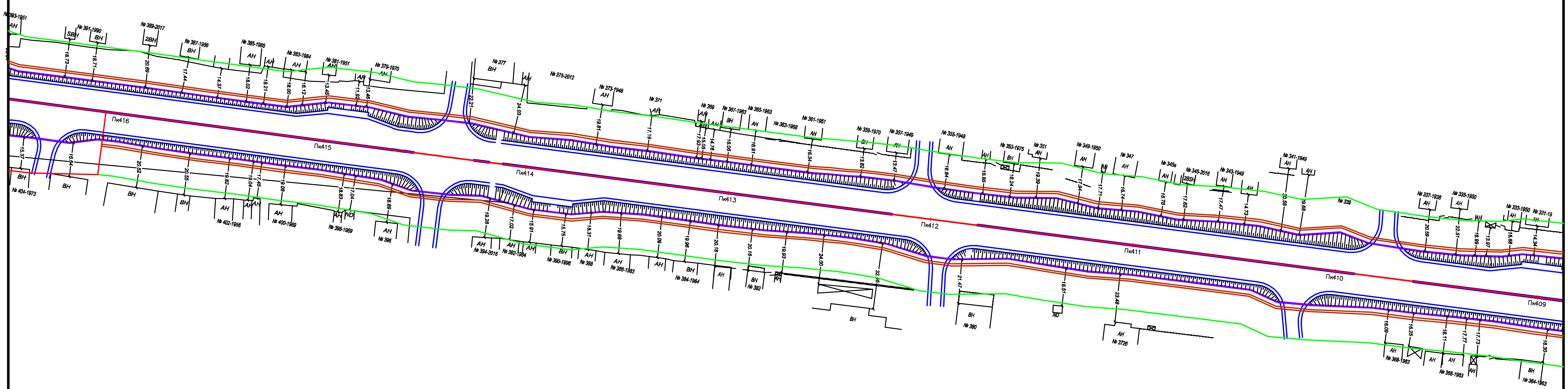

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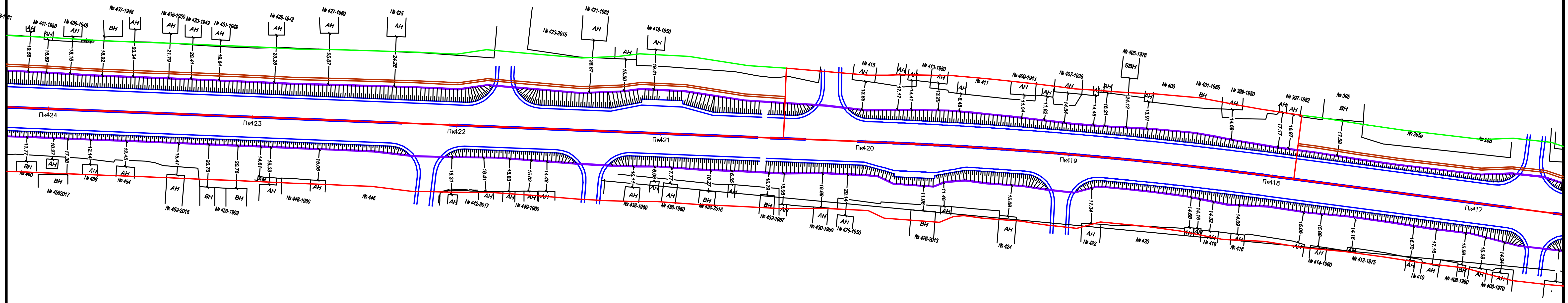

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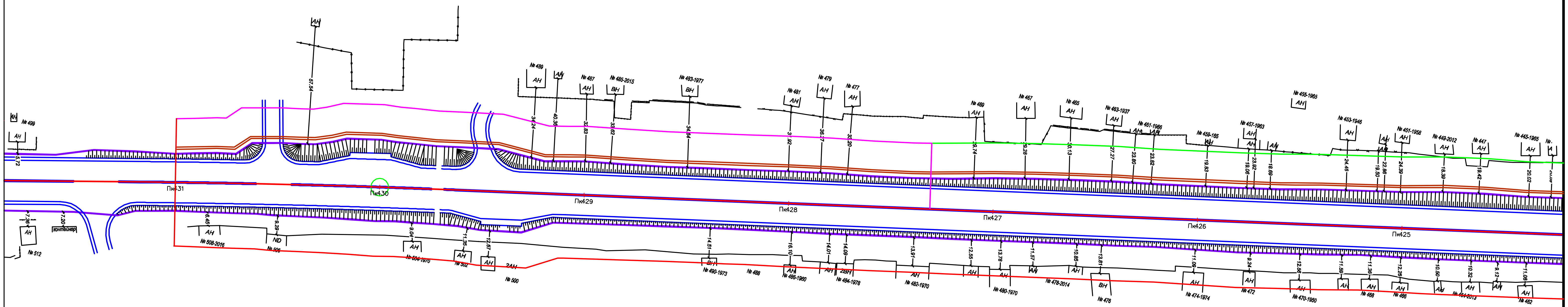

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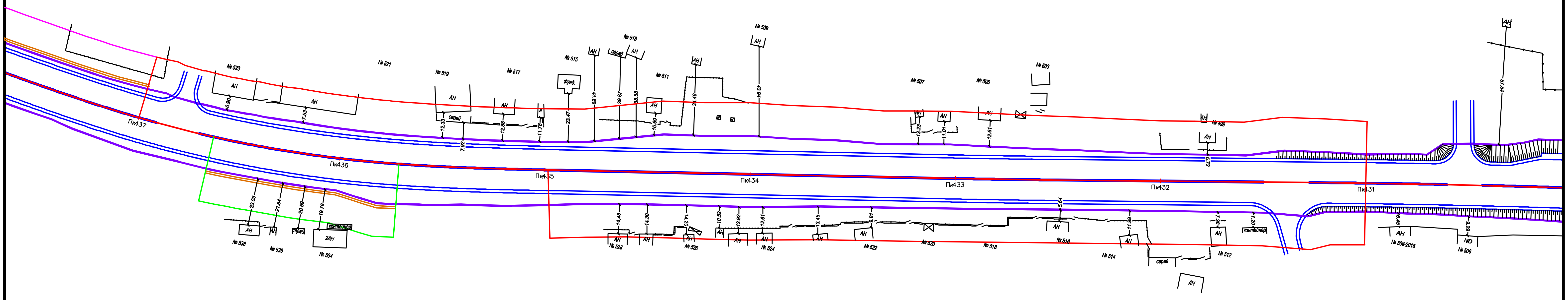
Vibration Modeling Contours
(PK431+00~PK457+00)



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Vibration Modeling Contours
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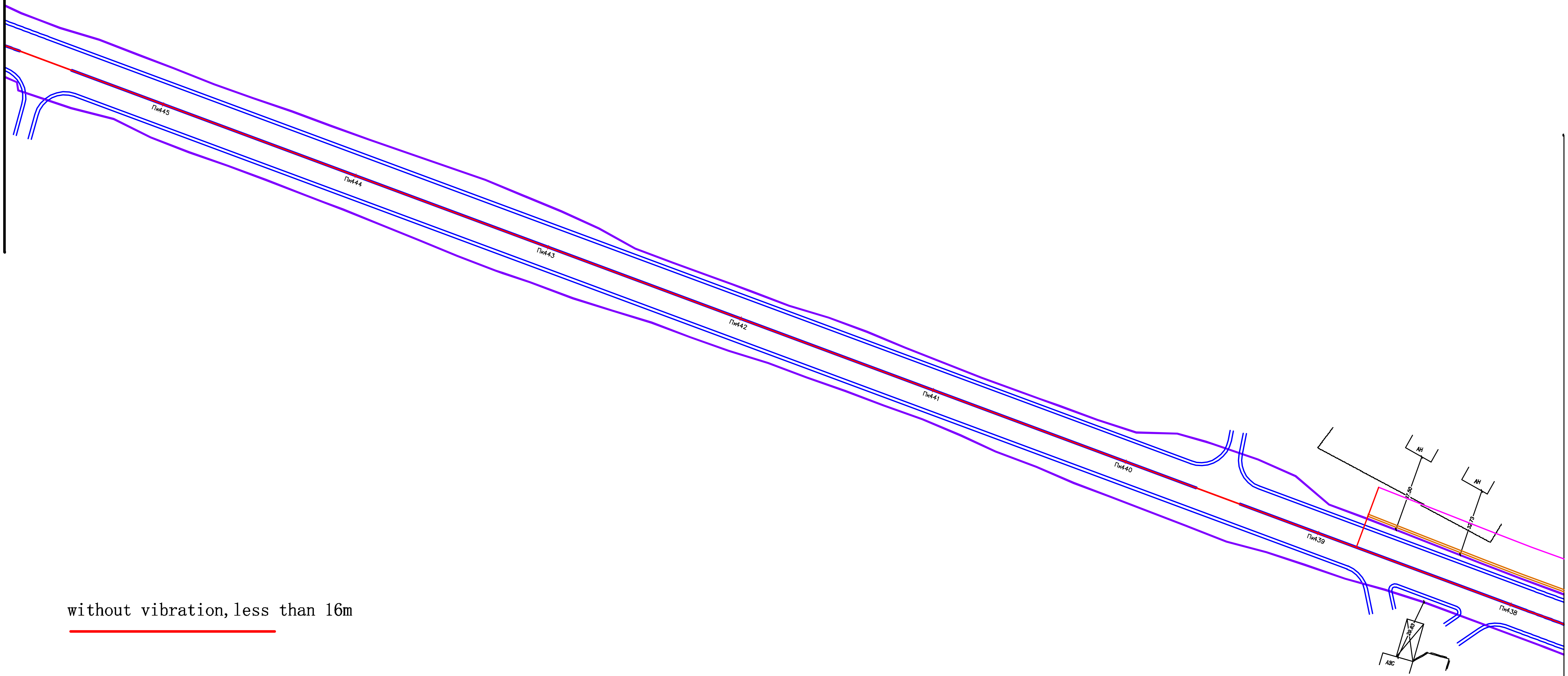

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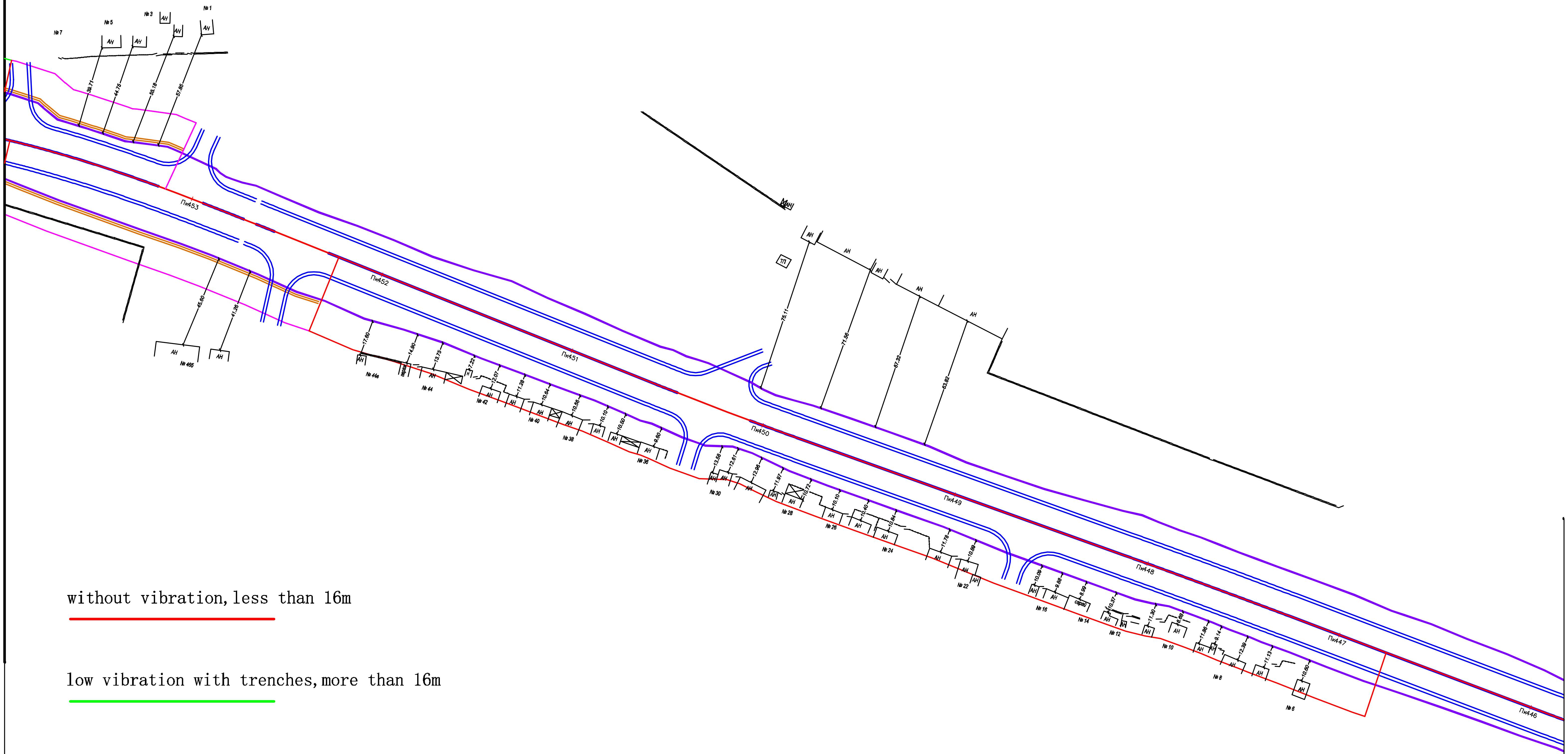

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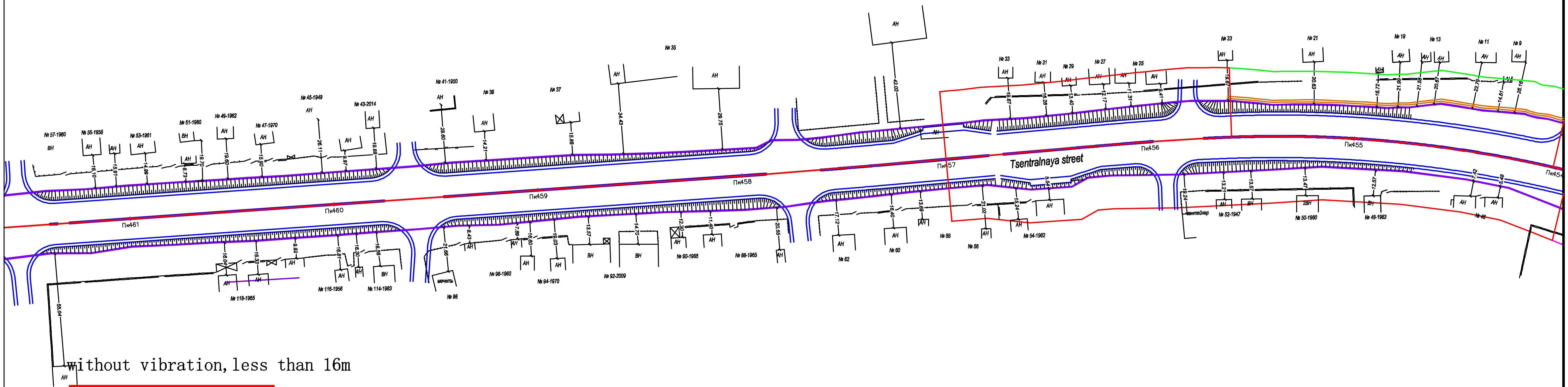

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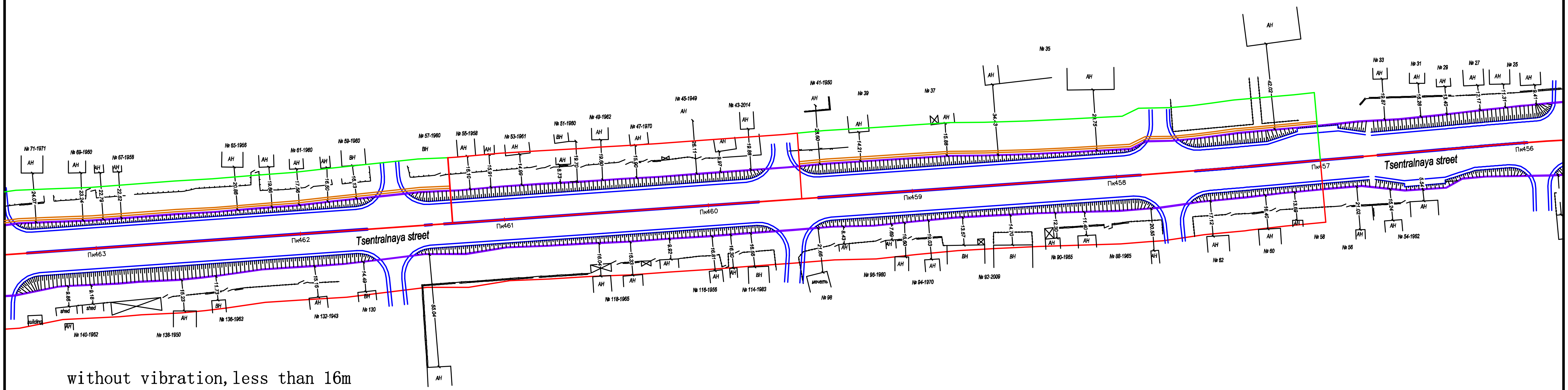
Vibration Modeling Contours
(PK457+00~PK508+20)



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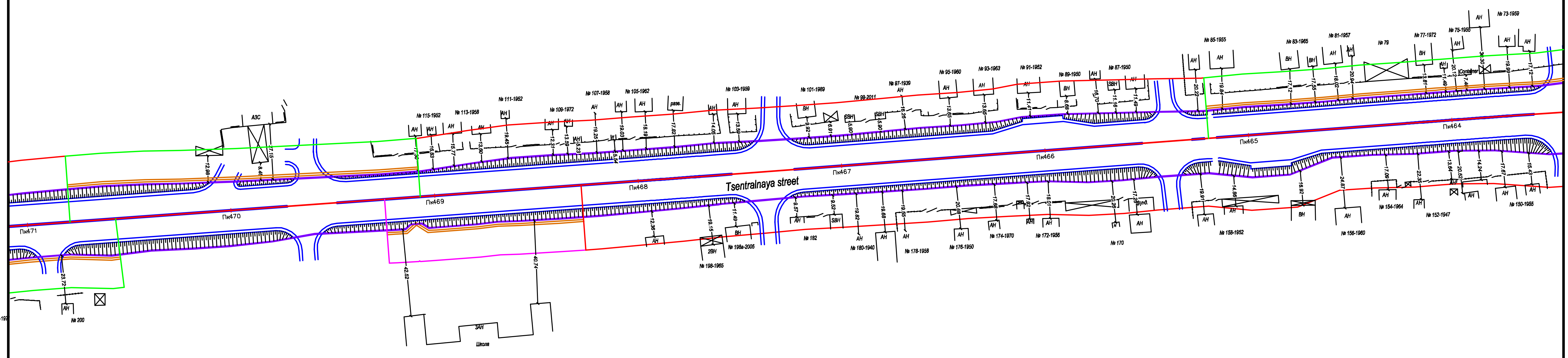
SBH – Slag block house

ND – Non dwelling building

CAREC Carridor 3 (Bishkek-Osh Road) Improvement Project	China Railway No.5 Engineering Co. Ltd.	Plan of Risk-free Sub-sections in Section 3 (PK74+00-PK526+00)	design	approvel	date	

Vibration Modeling Contours
(PK457+00~PK508+20)



without vibration, less than 16m

low vibration with trenches, more than 16m

high vibration with trenches, more than 32m

trench (approximate plotting)

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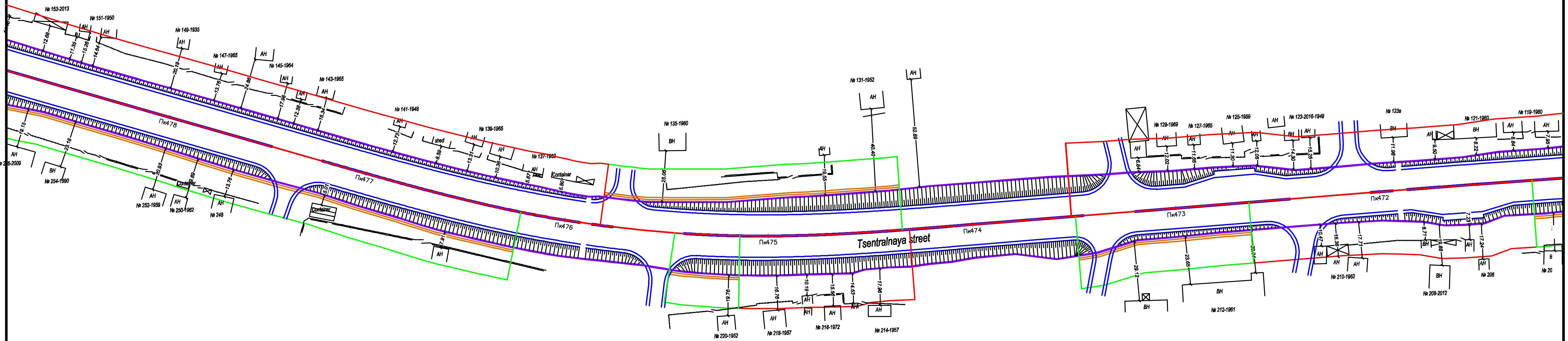
Vibration Modeling Contours
(PK457+00~PK508+20)



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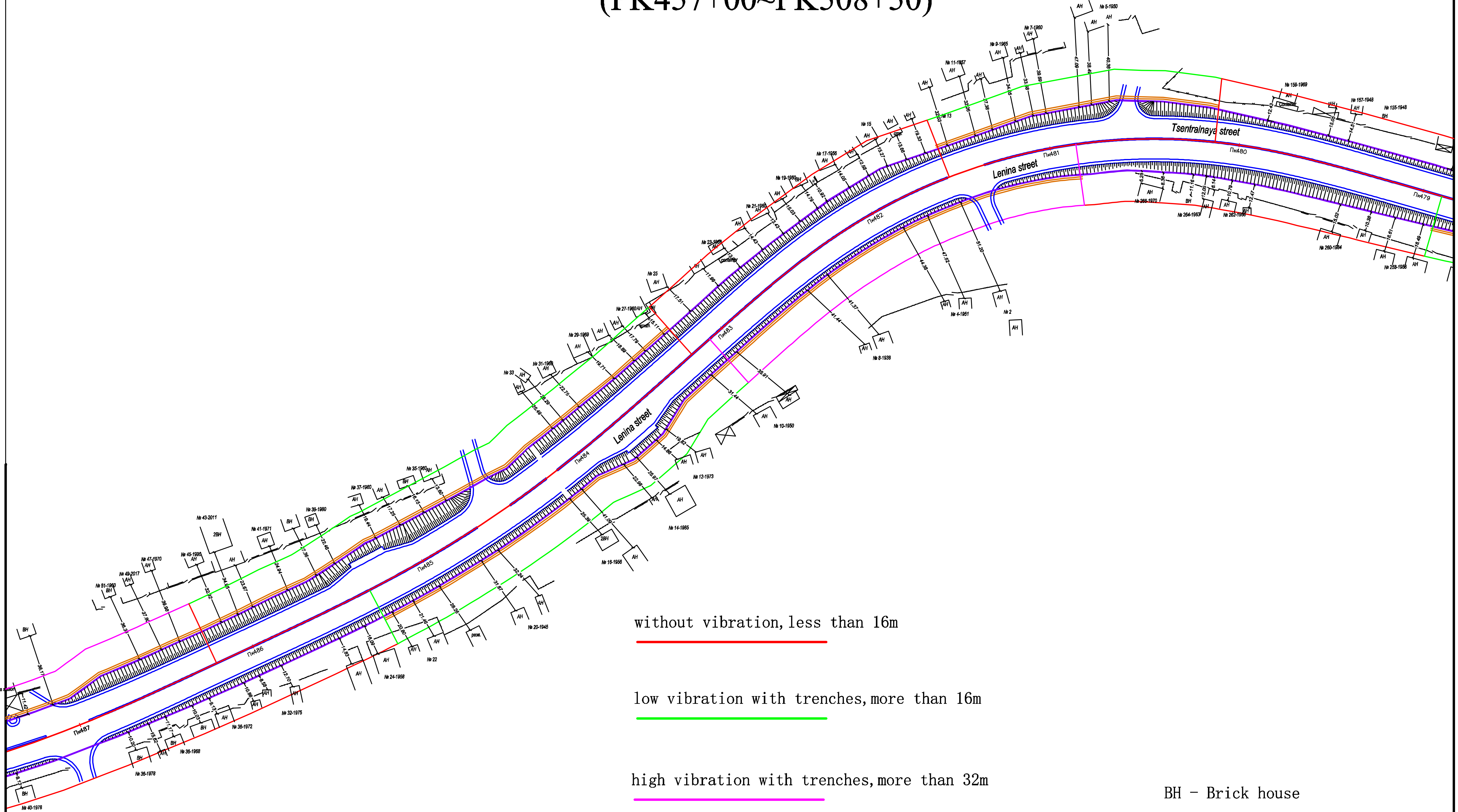
Vibration damage contours
(PK457+00~PK508+50)



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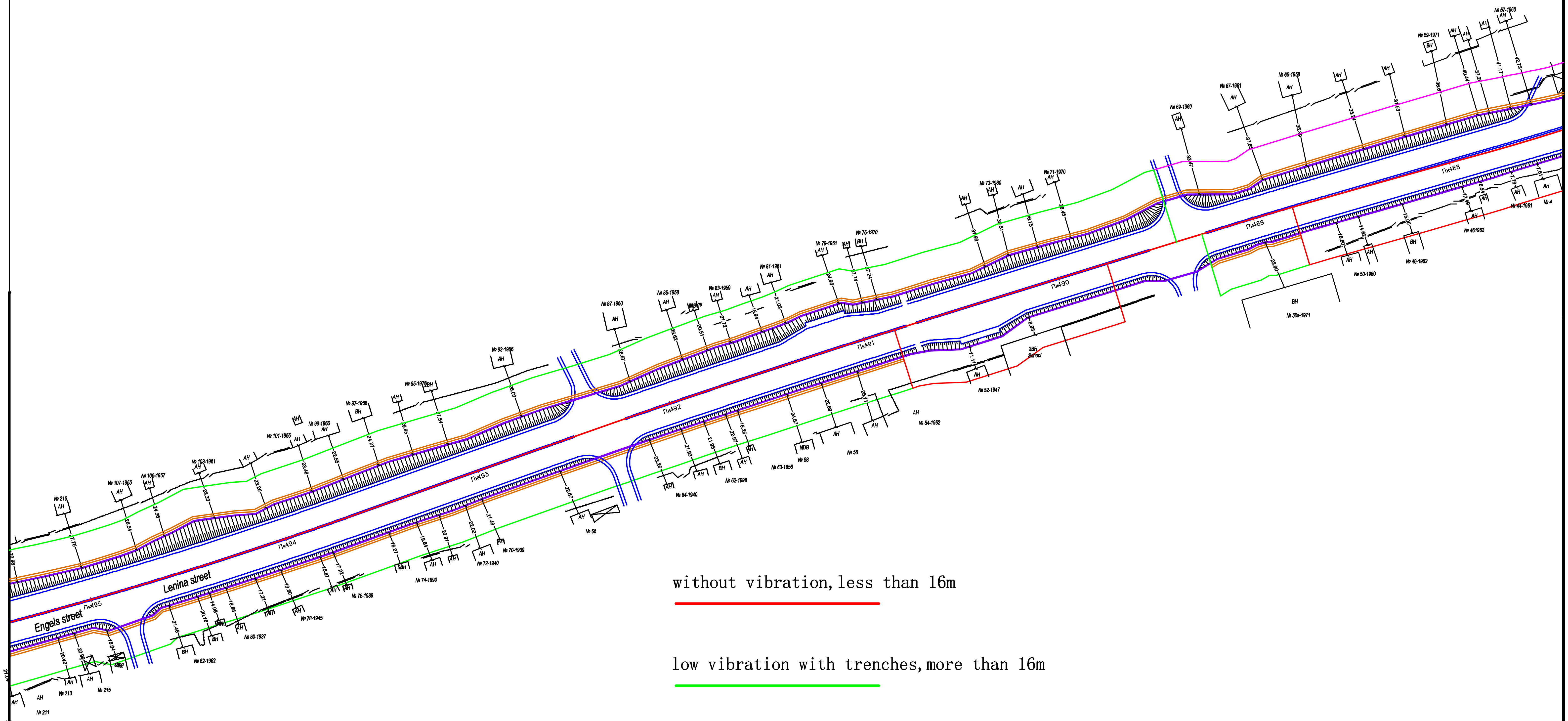
Vibration damage contours
(PK457+00~PK508+50)



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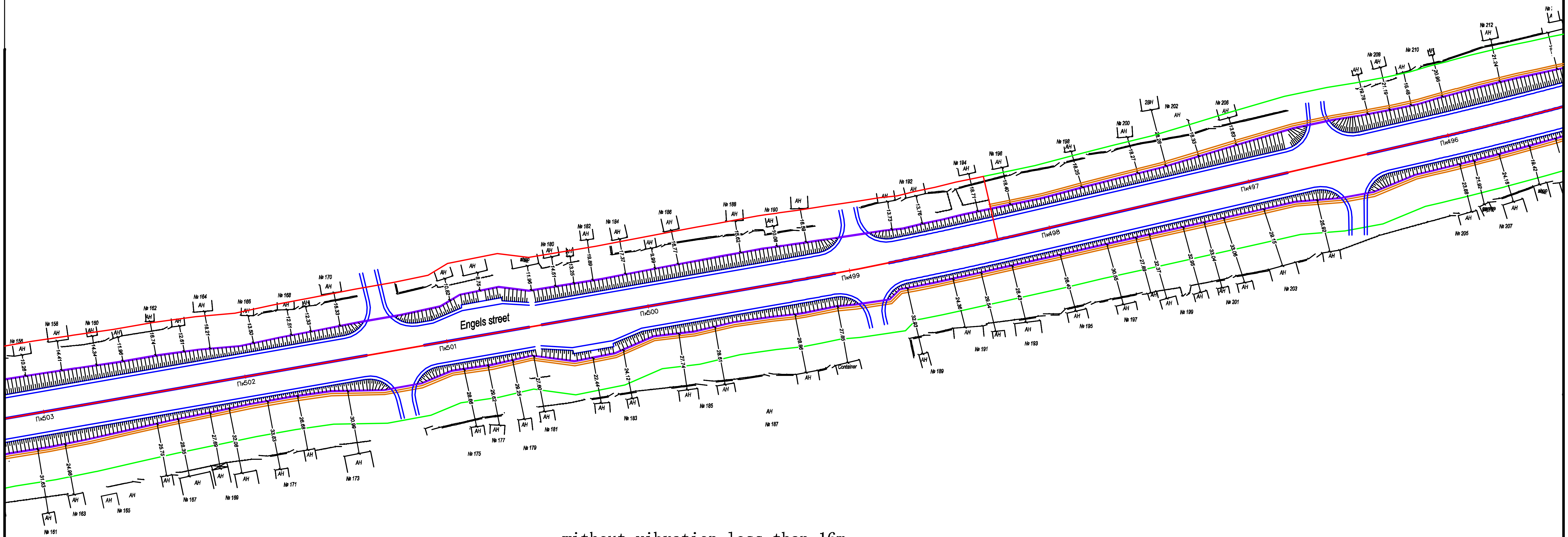
(PK457+00~PK508+50)



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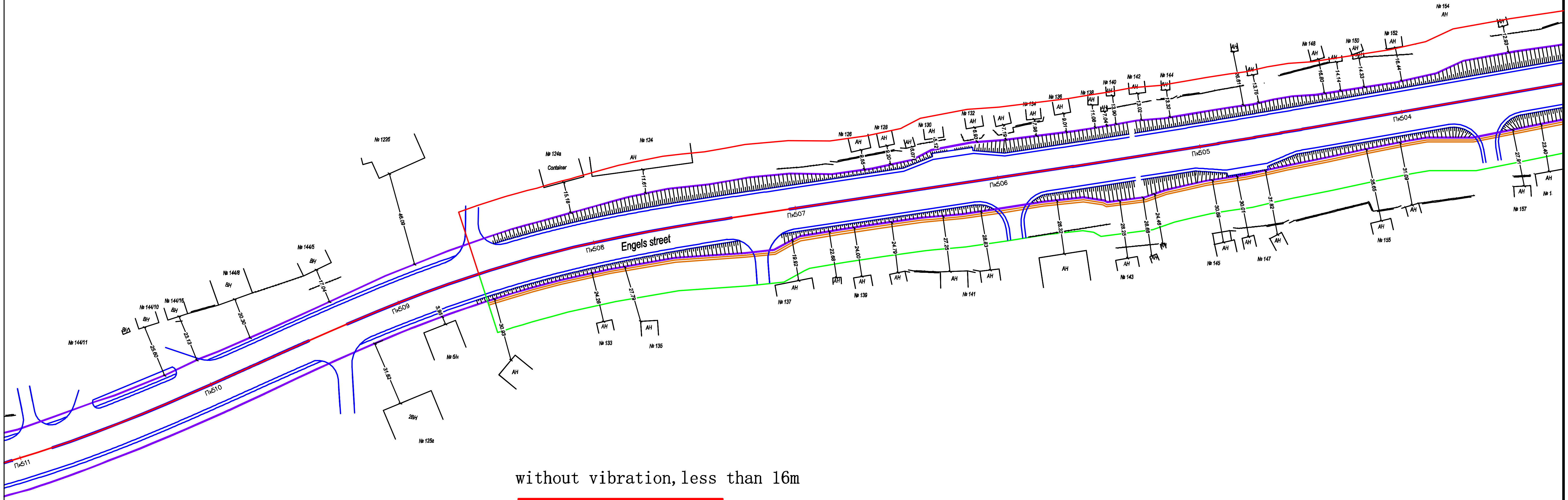
Vibration damage contours
(PK457+00~PK508+50)



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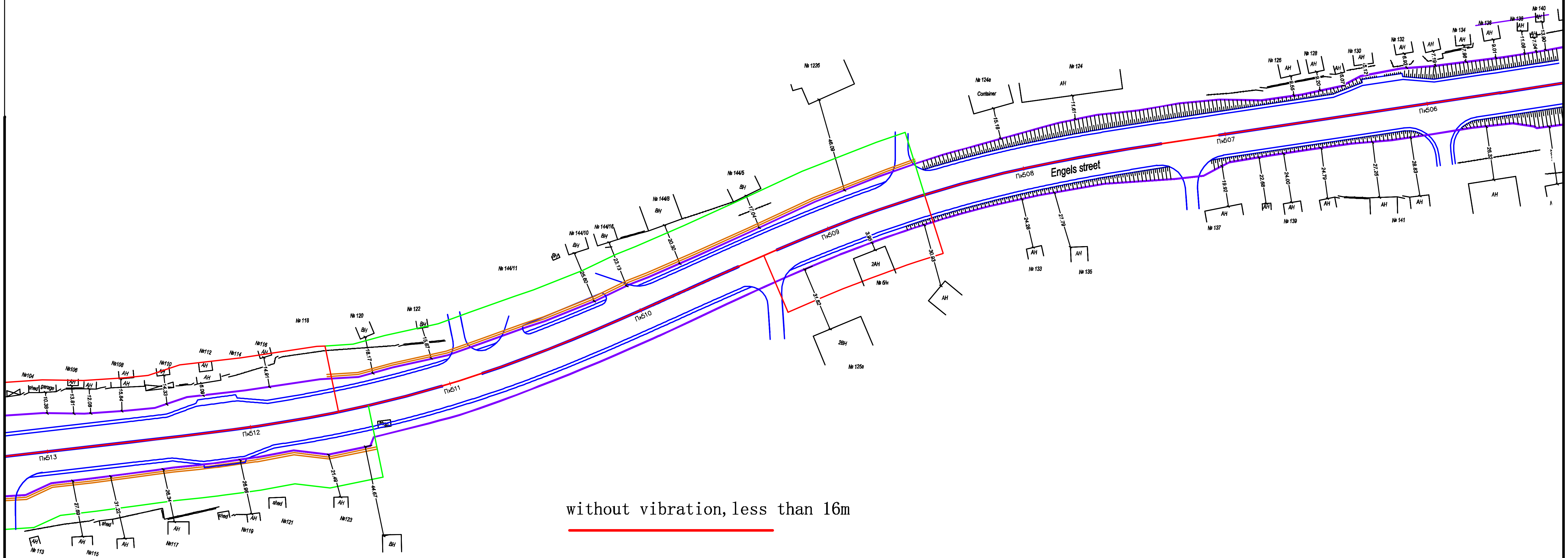
Vibration Modeling Contours
(PK508+50~PK525+00)



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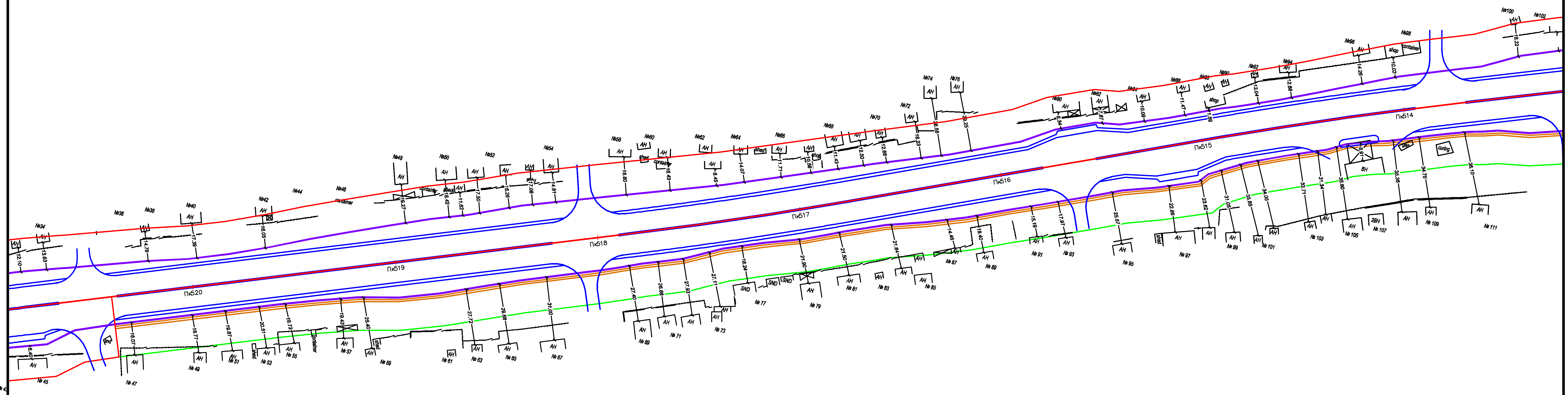

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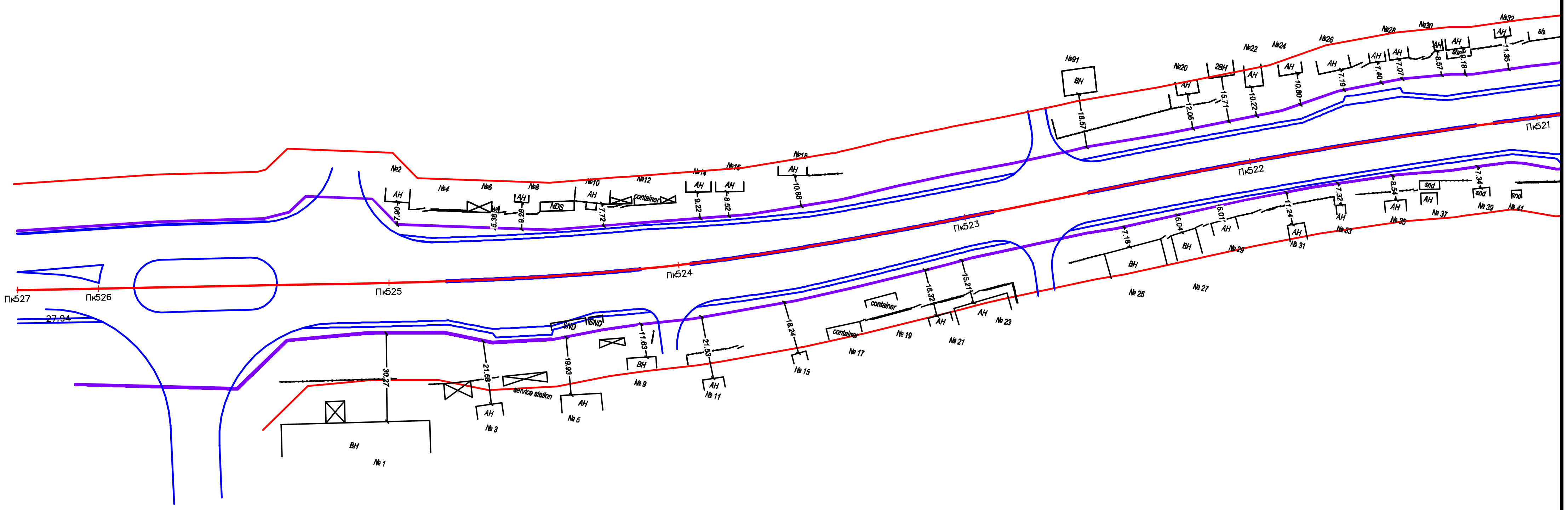

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The list of impacts on the site 1.1 PK74 + 00-PK128 + 00

Right side

Houses up to 16 meters.
Compaction without vibration

from	to	m
126+00	128+00	200
	total	**200**

Houses more than 16 meters.
Compaction with low vibration
using a trench

from	to	m
81+33	83+16	183
114+53	121+33	680
123+11	126+00	289
	total	**1152**

Houses more than 32 meters
Compaction with vibration using
a trench

from	to	m
121+33	121+74	41
	total	**41**

No houses - compaction with
vibration without trenches

from	to	m
74+00	81+33	733
83+16	114+53	3137
121+74	123+11	137
	total	4007

Left side

Houses up to 16 meters.
Compaction without vibration

from	to	m
82+75	84+22	147
117+83	121+91	408
123+68	128+00	432
	total	**987**

Houses more than 16 meters.
Compaction with low vibration
using a trench

from	to	m
110+34	111+68	134
112+82	113+52	70
115+25	117+83	258
121+91	122+53	62
	total	**524**

Houses more than 32 meters
Compaction with vibration using
a trench

from	to	m
122+53	123+68	115
	total	**115**

No houses - compaction with
vibration without trenches

from	to	m
74+00	82+75	875
84+22	110+34	2612
111+68	112+82	114
113+52	115+25	173
	total	**3774**

The list of impacts on the site 2.1 PK128+00-PK270+00

Right side

Houses up to 16 meters.
Compaction without vibration

from	to	п.м.
128+00	133+08	508
134+77	150+42	1565
152+11	157+70	559
159+83	181+23	2140
182+75	185+36	261
186+19	191+83	564
194+59	205+41	1082
207+09	208+17	108
210+80	213+77	297
218+49	270+00	5151
		0
		0
		0
		0
		0
	total	**12235**

Houses more than 16 meters.
Compaction with low vibration using a trench

from	to	п.м.
133+08	134+77	169
150+42	152+11	169
157+70	159+83	213
193+70	194+59	89
205+41	207+09	168
208+17	210+80	263
213+77	218+49	472
		0
		0
		0
	total	**1543**

Houses more than 32 meters
Compaction with vibration using a trench

from	to	п.м.
		0
		0
	total	**0**

Left side

Houses up to 16 meters.
Compaction without vibration

from	to	п.м.
128+00	132+14	414
133+82	134+76	94
143+61	152+55	894
155+04	156+56	152
158+68	160+85	217
161+86	170+45	859
173+56	181+04	748
182+39	195+08	1269
197+05	216+48	1943
217+92	229+19	1127
233+73	240+28	655
247+41	249+01	160
255+46	256+54	108
257+85	263+01	516
268+66	270+00	134
	total	**9290**

Houses more than 16 meters.
Compaction with low vibration using a trench

from	to	п.м.
132+14	133+82	168
134+76	142+55	779
152+55	155+04	249
156+56	158+68	212
181+04	182+39	135
229+19	233+73	454
240+28	247+41	713
249+01	255+46	645
263+01	265+89	288
268+00	268+66	66
	total	**3709**

Houses more than 32 meters
Compaction with vibration using a trench

from	to	п.м.
170+45	173+56	311
195+08	197+05	197
	total	**508**

No houses - compaction with vibration without a trench

from	to	п.м.
181+23	182+75	152
185+36	186+19	83
191+83	193+70	187
		0
		0
	total	422

No houses - compaction with vibration without a trench

from	to	п.м.
142+55	143+61	106
160+85	161+86	101
216+48	217+92	144
256+54	257+85	131
265+89	268+00	211
	total	**693**

The list of impacts on the site 1.3 PK371 + 00-PK431 + 00

Right side

Houses up to 16 meters.
Compaction without vibration

from	to	m
270+00	316+26	4626
317+77	320+80	303
	total	**4929**

Houses more than 16 meters.
Compaction with low vibration using a trench

from	to	m
316+26	317+77	151
	total	**151**

Houses more than 32 meters
Compaction with vibration using a trench

from	to	m
	total	**0**

No houses - compaction with vibration without trenches

from	to	m
		0
	total	0

Left side

Houses up to 16 meters.
Compaction without vibration

from	to	m
270+00	287+08	1708
290+69	320+80	3011
	total	**4719**

Houses more than 16 meters.
Compaction with low vibration using a trench

from	to	m
287+08	289+76	268
	total	**268**

Houses more than 32 meters
Compaction with vibration using a trench

from	to	m
	total	**0**

No houses - compaction with vibration without trenches

from	to	m
289+76	290+69	93
	total	**93**

The list of impacts on the site 2.2 PK320+80-PK371 + 00

Right side

Houses up to 16 meters.
Compaction without vibration

from	to	п.м.
320+80	322+21	141
322+89	335+00	1211
335+48	354+12	1864
356+08	371+00	1492
	total	**4708**

Houses more than 16 meters.
Compaction with low vibration using a trench

from	to	п.м.
		0
	total	**0**

Houses more than 32 meters
Compaction with vibration using a trench

from	to	п.м.
355+72	356+08	36
	total	**36**

No houses - compaction with vibration without a trench

from	to	п.м.
322+21	322+89	68
335+00	335+48	48
354+12	355+72	160
	total	**276**

Left side

Houses up to 16 meters.
Compaction without vibration

from	to	п.м.
320+80	353+34	3254
355+83	360+91	508
361+39	371+00	961
	total	**4723**

Houses more than 16 meters.
Compaction with low vibration using a trench

from	to	п.м.
353+34	354+82	148
	total	**148**

Houses more than 32 meters
Compaction with vibration using a trench

from	to	п.м.
		0
	total	**0**

No houses - compaction with vibration without a trench

from	to	п.м.
354+82	355+83	101
360+91	361+39	48
	total	**149**

The list of impacts on the site 1.3 PK371+00-PK431+00

Right side

Houses up to 16 meters.
Compaction without vibration

from	to	m
371+00	378+91	791
382+46	384+98	252
417+89	420+40	251
	total	**1294**

Houses more than 16 meters.
Compaction with low vibration using a trench

from	to	m
384+98	417+89	3291
420+40	427+31	691
	total	**3982**

Houses more than 32 meters
Compaction with vibration using a trench

from	to	m
378+91	379+58	67
427+31	431+00	369
	total	**436**

No houses - compaction with vibration without trenches

from	to	m
379+58	382+46	288
	total	288

Left side

Houses up to 16 meters.
Compaction without vibration

from	to	m
371+00	378+91	791
384+36	390+21	585
396+60	401+50	490
416+08	431+00	1492
	total	**3358**

Houses more than 16 meters.
Compaction with low vibration using a trench

from	to	m
382+46	384+36	190
390+21	396+60	639
401+50	416+08	1458
	total	**2287**

Houses more than 32 meters
Compaction with vibration using a trench

from	to	m
		0
	total	**0**

No houses - compaction with vibration without trenches

from	to	m
378+91	382+46	355
	total	**355**

The list of impacts on the site 2.3 PK431 + 00-PK457 + 00

Right side

Houses up to 16 meters.
Compaction without vibration

from	to	п.м.
431+00	437+00	600
455+60	457+00	140
	total	**740**

Houses more than 16 meters.
Compaction with low vibration
using a trench

from	to	п.м.
454+02	455+60	158
	total	**158**

Houses more than 32 meters
Compaction with vibration using
a trench

from	to	п.м.
437+00	438+80	180
453+14	454+02	88
	total	**268**

No houses - compaction with
vibration without a trench

from	to	п.м.
438+80	453+14	1434
	total	**1434**

Left side

Houses up to 16 meters.
Compaction without vibration

from	to	п.м.
431+00	434+99	399
446+75	452+23	548
453+94	457+00	306
	total	**1253**

Houses more than 16 meters.
Compaction with low vibration
using a trench

from	to	п.м.
435+71	436+62	91
	total	**91**

Houses more than 32 meters
Compaction with vibration using
a trench

from	to	п.м.
452+23	453+94	171
		0
	total	**171**

No houses - compaction with
vibration without a trench

from	to	п.м.
434+99	435+71	72
436+62	446+75	1013
	total	**1085**

The list of impacts on the site 1.4 PK457+00-PK508+50

Right side

Houses up to 16 meters.
Compaction without vibration

from	to	m
459+54	461+25	171
465+20	469+07	387
470+79	473+51	272
475+83	480+13	430
481+55	483+21	166
498+26	508+50	1024
	total	**2450**

Houses more than 16 meters.
Compaction with low vibration
using a trench

from	to	m
457+00	459+54	254
461+25	465+20	395
469+07	470+79	172
474+34	475+83	149
480+13	481+55	142
483+21	486+21	300
489+40	498+26	886
	total	**2298**

Houses more than 32 meters
Compaction with vibration using
a trench

from	to	m
486+21	489+40	319
	total	**319**

No houses - compaction with
vibration without trenches

from	to	m

Left side

Houses up to 16 meters.
Compaction without vibration

from	to	m
457+00	468+28	1128
471+25	472+64	139
474+31	475+14	83
478+90	480+86	196
485+32	488+80	348
489+75	490+84	109
	total	**2003**

Houses more than 16 meters.
Compaction with low vibration
using a trench

from	to	m
470+57	471+25	68
472+64	473+49	85
475+14	475+46	32
476+22	478+90	268
483+09	485+32	223
488+80	489+27	47
490+84	508+50	1766
	total	**2489**

Houses more than 32 meters
Compaction with vibration using
a trench

from	to	m
468+28	469+18	90
480+86	483+09	223
	total	**313**

No houses - compaction with
vibration without trenches

from	to	m

473+51	474+34	83
	total	83

469+18	470+57	139
473+49	474+31	82
475+46	476+22	76
489+27	489+75	48
	total	**345**

The list of impacts on the site 2.4 PK508 + 50-PK525 + 00

Right side

Houses up to 16 meters.
Compaction without vibration

from	to	п.м.
511+56	525+00	1344
		0
	total	**1344**

Houses more than 16 meters.
Compaction with low vibration using a trench

from	to	п.м.
508+50	511+56	306
	total	**306**

Houses more than 32 meters
Compaction with vibration using a trench

from	to	п.м.
		0
	total	**0**

No houses - compaction with

from	to	п.м.
		0
	total	**0**

1650

Left side

Houses up to 16 meters.
Compaction without vibration

from	to	п.м.
508+50	509+26	76
520+40	525+00	460
	total	**536**

Houses more than 16 meters.
Compaction with low vibration using a trench

from	to	п.м.
511+41	520+40	899
	total	**899**

Houses more than 32 meters
Compaction with vibration using a trench

from	to	п.м.
		0
	total	**0**

No houses - compaction with

from	to	п.м.
509+26	511+41	215
	total	**215**

1650

Annex 3

Construction Environmental Management Work plan: Mitigation and Monitoring Table

N°	Environment Issue	Mitigative Measures	Time Frame	Location	Implement By/ Supv. By	Monitoring Action	Timing	The Deliverable	Implementing	Supervising
1	**PRECONSTRUCTION PREPARATION PERIOD (not included as this is meant for the construction period)**									
2	**CONSTRUCTION PERIOD**									
2.2	**Dust and Air Quality**	**MITIGATION**				**MONITORING**				
2.2.1	Dust Generation: Transportation of Material: A small increase in particulate matter (dust) is expected at the location of rehabilitation works and from vehicles hauling materials to the rehabilitation areas. **SEE SSEMP ANNEX 9**	III. The Contractor will be required to spray water on uncovered sand and gravel layers in dry periods within villages and near houses located close to the road and to cover the trucks used for transport. V. Watering during dry periods and setting strict speed limits of no more than 30kph across the rehabilitation sections will control dust at the construction site.	Throughout the construction period	Anywhere where there is material moved, earthworks cutting and filling.	Contractor/ CSC	Travel work areas and check for dust—and if found take immediate action with contractor	Anywhere where there is material moved, earthworks cutting and filling.	Written and dated note indicating compliance or issue and action taken	IPIG	CSC
2.2.2	Dust Generation: Quarry and Batching Plant Operation and removal and placement of cut and fill materials respectively, including asphalt. Pavement crushing plant **SEE SSEMP**	V. The works will include large concrete works for and shall be carried out without a batching plant. Therefore no mitigation is required. VI. Slow and controlled mixing of the cement with aggregate to produce concrete shall minimize dust during manual batching for small concrete structure. VII. dust during material extraction and movement shall be	i-iii Throughout the construction period	i-ii Anywhere where there is material moved, earthworks cutting and filling. iii-all work sites at all times.	Contractor/ CSC	Travel to Quarry and Works site and check for dust—and if found take immediate action with contractor.	I – iii. Throughout the construction period	Written and dated note indicating compliance or issue and action taken	CEE	CSC

N°	Environment Issue	Mitigative Measures	Time Frame	Location	Implement By/ Supv. By	Monitoring Action	Timing	The Deliverable	Implementing	Supervising
	ANNEX 9, AND 13	controlled through transport in batched trucks and watering during dry period. III. The > 1 million m3 of asphalt-concrete wearing course of the existing road will be totally replaced, requiring the excavation, storage, reprocessing and reuse of the granulated material as road sub-base or recycled for use on secondary roads. Pavement milling/scraping, crushing and reprocessing generates large quantities of dust, Therefore, dust suppression equipment, and protective gear for workers, will be required. Dust control via watering and road cleaning wil be conducted daily with watering at least 4 hours every day.								
2.2.3	Increase in air pollution from vehicular and machinery exhaust **SEE SSEMP ANNEX 9**	Emissions will be minimized by: ix. ensuring that the contractor's fleet of vehicles are properly maintained according to manufacturer's specifications; x. use of appropriate octane fuel and haul loads within specified limits. xi. Vehicle idling time when not in use, limited to no more than 3 minutes, xii. Equipment such as the diesel generator will be included in the emission control program and will be and regularly tuned	During the Construction period	Construction Site	Contractor/ CSC	Record findings and conduct regular inspections in association with construction supervision	During the Construction period	Inspection Note to file for use in contractor's reporting and in audit reports.	CEE	CSC

N°	Environment Issue	Mitigative Measures	Time Frame	Location	Implement By/ Supv. By	Monitoring Action	Timing	The Deliverable	Implementing	Supervising
		to prevent excessive temporary pollution.								
2.3	Solid waste management at the construction site **SEE SSEMP ANNEX 4 & 5**	No open incineration of solid waste (garbage) and construction materials shall be permitted on site. All plastics , paper and useable wood will be recycled. Wood scraps can be burned.	During the Construction period	Construction Site	Contractor/ CSC	Record findings and conduct regular inspections in association with construction supervision	During the Construction period	Inspection Note to file for use in contractor's reporting and in audit reports.	CEE	CSC
2.4	**Surface and Groundwater**									
2.4.1	**Contamination of Water Resources (Surface & Groundwater)** Surface water can result from leaking fuel storage, liquid bitumen and other chemicals used in rehabilitation works. **SEE SSEMP ANNEX 7 & 8** Groundwater contamination from surface runoff leaking into roadside wells. **SEE SSEMP ANNEX 8**	iv. Fuel and oil storage areas should be at least 500m away from watercourses and repair yards to be equipped with an impervious platform, with interceptor traps so that any fuel leakage is retained within the site. v. All fuel storage sites must be checked daily for leaks and held in an impervious site where spilled/leaking material can be collected. vi. Wash down water from machinery repair areas to be directed into this system that retains the oil and grease. Refueling not to be permitted within or adjacent to watercourses. Surface water channels crossed by the road will be monitored upstream and downstream of the road before, during and after the work has been completed on that crossing.	Throughout the construction period	All construction sites	Contractor / CSC	Regular inspection of work camps, contractors yard, fueling areas , fuel storage Water quality samples to be taken U/S and D/S of bridge construction sites, twice while work is ongoing at one section	Inspection at least monthly throughout the construction period. WQ sampling only 2X at bridge construction site- at start and midway through work; Oil and grease, TSS, pH and BOD 5 if possible	Checklist showing the check of fuel and lubricant handling, waste oil management, machinery was down water control, etc. signed and dated--filed. Checklist showing the check for lighting and signage signed and date filled Monitoring database	IPIG	Supervision Consultant

N°	Environment Issue	Mitigative Measures	Time Frame	Location	Implement By/ Supv. By	Monitoring Action	Timing	The Deliverable	Implementing	Supervising
2.4.2	Interruption / Contamination of Water channels: Movement/drainage of surface water interrupted due to improper culvert construction activities, inadequate diversions and notifications. **SEE SSEMP ANNEX 8 & 12**	v. Contractor should provide the adequate sized diversion, so that there shall be no disturbance to water flows of canal /watercourse. The placement of temporary culverts must avoid scouring and erosion and water leaves the temporary diversion vi. Protection mechanism should be provided to avoid contamination. vii. The land used for the temporary diversion and the water course shall be restored as far as possible to its initial state once the work has been completed	Construction period	Culverts and bridges	Contractor Safety Engineer /CSC	Inspection of diversion along the road, check signage, lighting any leakages at the diversions and rectify through contractor. Ensure contractor has adequately restored temporary work areas.	Construction period	Contractor EHS Officer	CEE	CSC
2.5	**Flora and Fauna**									
2.5.1	Loss of roadside vegetation and trees **SEE SSEMP ANNEX 10 & 11**	The project requires the cutting of around 4,000 mature trees, for which a plan has been prepared as defined Annex 11, a separate volume This must be fully adhered to and implemented completely by the contractor. Only trees marked for cutting will be removed. All cutting required shall be monitored according to the KR Law "General technical rules and regulations for environmental safety in the Kyrgyz Republic", #151, Clause 12 dtd. 08.05.2009. and the Law of KR "On Protection and Use of Flora", #53 dtd. 20.06.2001. To date tre replanting plans have been prepared for the following	Throughout the construction period when tree cutting is planned	At any locations where mature trees will be cut down.	Contractor/ CSC	-Inspect tree planting and maintenance operation and confirm compliance with mitigation item 2.5.1 and Annex Volume 10. Also provide ongoing list of tree planting activity	Throughout the construction period when tree cutting is planned	Compliance Monitoring Checklist filled in	CEE	CSC

N°	Environment Issue	Mitigative Measures	Time Frame	Location	Implement By/ Supv. By	Monitoring Action	Timing	The Deliverable	Implementing	Supervising
		sections: 1. Km 15.9-21.3 2. Km 35.5-40.5 3. Km 44.5.-51.6 4. Km 54.2-59.35 Sections 5-8 are scheduled for roadside tree removal and submission of plans will be completed These must be strictly adhered to As defined in the ESSEMP Annex 10, when work is finished in anyone area, tree replanting should start, i.e. not waiting until the entire road is completed.								
2.6	**Spoil and Solid Waste**									
2.6.1	Inappropriate use of asphalt layers and base materials removed from the existing road . **SEE SSEMP ANNEX 7**	Demolished asphalt may be re-used in the soft shoulders or as fill for other parts of the rehabilitation works. It may also be used as back-fill for borrow pits and then over-lain with topsoil. Asphalt pieces can be spread on adjacent roads as surface or pothole fill material and compacted.	During Construction	All Construction Sites	Contractor/ CSC	Monitor to check waste handling and disposal procedure of contractor	Throughout construction period	Note to file, signed and dated	IPIG	Supervision Consultant
2.6.2	Unused construction material (sand, crush), empty drums, concrete waste and waste from work camps. **SEE SSEMP ANNEX 5 & 7**	iv. The contractor will identify dumping locations for construction debris and non-hazardous solid waste with DEP9/Bishkek-Osh and the CSC v. The contractor shall identify any hazardous waste as part of its health and safety plan and dispose of the material through an	During Construction	All Construction Sites	Contractor /CSC	Monitor to check waste handling and disposal procedure of contractor	Throughout construction period	Note to file, signed and dated	IPIG	Supervision Consultant

N°	Environment Issue	Mitigative Measures	Time Frame	Location	Implement By/ Supv. By	Monitoring Action	Timing	The Deliverable	Implementing	Supervising
		approved waste management contractor. vi. The cost of disposal of hazardous (lubricant drums, waste oil, hydraulic fluid, engine filters) and non-hazardous waste shall be included in the Contractors BOQ.								
2.7	**Quarry/Borrow Materials**									
2.7.1	Preservation of Top Soil **SEE SSEMP ANNEX 12 &13**	i. Excavation of earth fill will be limited to an appropriate depth of 20cm. ii. Where deep ditching is carried out, the top half-meter layer will be stripped and stockpiled. iii. The ditch will be filled initially with debris/scrap material from old construction and levelled with stockpiled topsoil later. iv. Where borrow pits cannot be fully rehabilitated, land owners will be compensated as provided in agreements between the land owner and contractor.	During Construction	At any locations where borrow pits, quarries will be operated.	Contract /CSC	iii. Confirm that topsoil has been set aside ii. Check quarry sites for depth.	During Construction period	Written and dated note indicating compliance or issue and action taken.	CEE/ IPIG	Supervision Consultant
2.7.2	Overloading of trucks, may damage pavement, bridges, and culverts	The Contractor will ensure that loaded trucks do not exceed road, bridge and pavement specifications and are checked by weighbridges. The contractor will be required to monitor the transport of material, recording vehicle movements and weights, to be inspected.	Throughout construction period	Construction sites	Contractor's CEE & Safety Engineer/ CSC	Examine weighbridge records and compare to amount of material moved	Throughout construction period	Inspection Note with findings, dated and signed	CSC	IPIG

N°	Environment Issue	Mitigative Measures	Time Frame	Location	Implement By/ Supv. By	Monitoring Action	Timing	The Deliverable	Implementing	Supervising
2.7.3	Opening of new borrow pits without permit or management plan **SEE SSEMP ANNEX 14**	If new borrow pit is required contractor will: **1.** Prepare a sketch map of site to be used, access road and volume to be extracted, then seek approval from CSC. **2**. Get approval for the site, based in KR regulation and agreement with landowner; **3.** Open the site by first stockpiling topsoil and securing the area against erosion. **4.** Decommission the site after work is complete, including landscaping and revegetation: 5.Prepare a table showing the 5 actions and notation of what action was taken, sign it and submit to CSC.	Prior to the opening of any new borrow site	At any site where material is take for the road construction, either outside or inside the impact corridor	Contractor/ CSC/IPIG	Confirm documentation prepared as defined in mitigative action No. 2.7.3	Prior to the opening of any new borrow site	Copy of documentation or permit no.	CSC and CEE	IPIG
2.7.4	Risk of erosion and destruction of landscape from side borrow operations. **SEE SSEMP ANNEX 13**	Side- borrowing along or outside the RoW will not be permitted unless a construction emergency arises, and which will trigger a mandatory consultation with the Environmental Officer of IPIG.	Throughout the construction period	Along all 45.1 km of the project road	Contractor and CSC	Inspect all side borrow activities and establish what permission given, and if none require immediate closure and restoration of the site.	Throughout construction period	Permit and relevant documentation on file	CSC and CEE	IPIG
2.8	**Noise and Vibration**	1. Construction period noise controlled by use of reduced noise machines and no night time operation in urbanized areas 2. No vibration issues	Noise—quarterly No vibration actions needed	At sensitive receptor sites	Contractor	No monitoring needed for vibration	Qnarterly	Data table	CSC and CEE	IPIG
2.9	**Health & Safety**									
2.9.1	Damage / disturbance to Utilities within RoW **SEE SSEMP ANNEX 3 & 4**	Removal and relocation of power, water, and other utilities to make way for construction must be conducted through a consultation-first approach, followed by removal and immediate replacement	-At start of construction for the entire 45.1 km--	Along the entire alignment	Contractor / CSC	i. Inspect construction areas where access is an issue and establish if contractor is managing problem and if local residents are satisfied.	Throughout construction period	Inspection note with findings, dated and signed	Contractor's CEE, CSSC and IPIG	Supervising Consultant

N°	Environment Issue	Mitigative Measures	Time Frame	Location	Implement By/ Supv. By	Monitoring Action	Timing	The Deliverable	Implementing	Supervising
						ii. Always identify by clear signage according to regulation maintenance activities on the roadway				
2.9.3	Health and Safety Concerns: Protecting the workforce and maintaining a safe working environment. **SEE SSEMP ANNEX 3 & 4**	iv. Contractor must provide safety vests, hard hats and protective footwear for all workers handling heavy machinery, and working with hazardous materials such as concrete, asphalt, paints, and cleaning agents . v. Contractor must provide protective masks to machine operators, where dust can be generated, and to anyone working in the area of the machines, with masks of a micron size, capable of capturing dust down to 2 microns. vi. Any works at night should be adequately lit and high visibility clothing worn and contractor should provide basic training on use of protective clothing and equipment.	Construction period	Contractor's Depots and all work areas, including those of sub-contractor	Contractor's Safety Engineer and CEE / CSC	Inspect all operations in the depots including worker housing and all waste management procedures.	Throughout the construction period	Inspection note re findings, dated and signed.	Contractor's CEE, CSSC and IPIG	Supervising Consultant
2.9.4	Contractor's work areas and depots not maintained, no proper waste management, environmental health and safety measures.	iv. All depots shall be provided with septic sanitation facilities and potable water. v. Monitoring will be required for the solid waste disposal at the depot and to ensure that the health and safety plan based on contract specifications is followed.	Throughout the construction period	Contractor's Depots and all work areas, including those of sub-contractor	Contractor's Safety Engineer and CEE / CSC	CEE and Safety Engineer to conduct regular inspections of sites	Weekly , during the construction period	Inspection checklist addressing three items listed here	CEE	CSC

N°	Environment Issue	Mitigative Measures	Time Frame	Location	Implement By/ Supv. By	Monitoring Action	Timing	The Deliverable	Implementing	Supervising
	SEE SSEMP ANNEX 4	vi. During operation, the surface of the depot used for storage of construction materials shall be protected against run-off and spills of hazardous materials using impermeable protection covering the ground and a system to collect contaminated run-off.								
2.10	Lack of contractor's construction period mitigation completion report	Contractor will be required to prepare a safeguards implementation completion checklist at the end of the construction period, discussing very briefly, each construction period EMP item.	Prior to final payment to contractor	NA	Contractor's CEE and Safety Engineer/ CSC	Inspect and collect report	Prior to final payment to contractor	Copy of report on file	CSC and Contractor	IPIG
2.11	Lack of transport and facility for CSC environmental auditor to conduct compliance monitoring.	The MOTR must file a semi-annual environmental monitoring report with ADB. Data for that will be assembled based on quarterly environmental inspections by the CSC's environmental specialist. Twice a year the Int'l Env. Specialist will conduct a due diligence compliance audit. To complete this work the CSC Env. Specialist will be provided with transportation as needed, as well as working space in the field	Conduct inspection of all operations every three months, including contractor yard, file semi annual monitoring report and Annual DD audit.	Across the entire construction area , including all subcontractor facilities	CSC and Contractor's CEE/ IPIG	Conduct inspection of all operations every three months, including contractor yard, file semi annual monitoring report and Annual DD audit.	Every three months	Copy of report	CSC and Contractor	CSC/IPIG
2.12	Failure to protect 13 sensitive site identified in the IEE	The 12-13 sites have been identified in Annex 2 of the IEE and parameter likely impacted identified, plus baseline measurements	Throughout the construction period	AT 12 sensitive sites using the sampling design	Contractor/ CSC	Examine field survey data on noise, air and surface water quality around the sensitive sites	Throughout the construction period	Data tables on file	CEE/CSC	CSC

N°	Environment Issue	Mitigative Measures	Time Frame	Location	Implement By/ Supv. By	Monitoring Action	Timing	The Deliverable	Implementing	Supervising
		obtained in 2013 , 2015 and again in 2017. A construction period air, noise and surface water quality testing program will be undertaken quarterly according to the design defined using GPS coordinates as defined in the in the IEE Annex 2 s.		provided in the IEE-and as specified in CEMP Items 2.4.1, 2.8.1 & 2.8.2						
3	**Operating Period; Contractor's Defect Year**									
3.1	Failure to fully decommission and clean up work area including garbage site, sewage, service area fuels and lubricant spills and erosion protection **SEE SSEMP ANNEX 12**	Buried garbage, latrine pits, fuel and lubricant and construction material such as bitumen left in and around the contractor's work area will be cleaned up and the area restored.	Within first 3 months of the defect period starting	At contractor offices and housing as well as all other work camps	CEE	Photo inspection/record of before and after	To take place before the end of the 8th month of the defect period	Photo record of before and after rehab. conditions	CEE	CSC
3.2	Contractor abandons used borrow sites leading to illegal mining, erosion and land degradation **SEE SSEMP ANNEX 14**	Borrow pit restoration according to plan defined in the IEE and earlier in this table, Activity 2.7	Within first 3 months of the defect period starting	At all borrow sites	CEE	CEE to provide photo record of before and after photos	To take place before the end of the 8th month of the defect period	Photo record of before and after rehab. conditions	CEE	CSC
3.3	Haul roads left abandoned not decommissioned leading to inappropriate use, erosion, damage to nearby property. **SEE SSEMP**	Close road as agreed to with local authorities and local land owners				Record of agreement with local authorities and photo of post-construction road use!	To take place before the end of the 8th month of the defect period	Photo record of before and after rehab. conditions	CEE	CSC

N°	Environment Issue	Mitigative Measures	Time Frame	Location	Implement By/ Supv. By	Monitoring Action	Timing	The Deliverable	Implementing	Supervising
	ANNEX 14									
3.4	Inadequate maintenance of large roadside tree plantation **SEE SSEMP ANNEX 10**	Based on MOTR's DEP9 guidance, ensure that trees planted remain healthy, are protected from grazing animals and receive water. Annual tree count will be required and any dead trees will need to replaced.	At the start of the operating period and every two months for the 1st year and semi annually for the next 2 years.	All areas where tree planting took place during the construction period	MOTR's highway maintenance unit/MOTR	Inspection of tree plantation and replanting dead trees and re-establishing better maintenance program	3 months before end of defect year	Tree inventory and replanting data sheet	Contractor's CEE	CSC
3.5	Aggregate crushing facilities, concrete plant and asphalt plant, especially bitumen storage areas are not cleaned up. **SEE SSEMP ANNEX 14**	Contractor to clean up and fully rehabilitate the sites	Within first six months of the defect year	Sites used for the activities defined in column 1	Contractor's CEE	Inspect and record clean up	Within first 6 months of start of operations of the rehabilitated roadway	Inspection record and photo evidence	CEE	CSC

CEE=Contractor's Environmental Engineer, MOTR=Ministry of Transportation and Roads, CSC=Construction Supervision Consultant (EPTISA), IPIG-International Project Implementation Group

Annex 3a
MONTHLY Environmental Compliance Monitoring Checklist
(Six A-3 sheets or 11 US Legal Size Sheets)

TO BE COMPLETED BY CONSTRACTOR'S ENVIRONMENTAL MONITOR

Inspector Name:
Inspection Date:
Construction Section:
Chainage:

N°	Environment Issue	Mitigative Measures	Time Frame	Location	Implement By/ Supv. By	Monitoring Action	Timing	The Deliverable	Contractor's CEE & CSC Reporting on Compliance: what as done, where and when
1	**PRECONSTRUCTION PREPARATION PERIOD-Not included as this is meant for the construction period**								**Activities 1.1-1.9 completed by CSC and IPIG**
2	**CONSTRUCTION PERIOD**								
2.2	**Dust and Air Quality**	**MITIGATION**				**MONITORING**			
2.2.1	Dust Generation: Transportation of Material: A small increase in particulate matter (dust) is expected at the location of rehabilitation works and from vehicles hauling materials to the rehabilitation areas. **SEE SSEMP ANNEX 11**	I. The Contractor will be required to spray water on uncovered sand and gravel layers in dry periods within villages and near houses located close to the road and to cover the trucks used for transport. II. Watering during dry periods and setting strict speed limits of no more than 30kph across the rehabilitation sections will control dust at the construction site.	Throughout the construction period	Anywhere where there is material moved, earthworks cutting and filling.	Contractor/ CSC	Travel work areas and check for dust—and if found take immediate action with contractor	Anywhere where there is material moved, earthworks cutting and filling.	Written and dated note indicating compliance or issue and action taken	
2.2.2	Dust Generation: Quarry and Batching	I. The works will include large concrete works for and shall be	i-iii Throughout	i-ii Anywhere where there is	Contractor/ CSC	Travel to Quarry and Works site and check for	I – iii. Throughout	Written and dated note	

N°	Environment Issue	Mitigative Measures	Time Frame	Location	Implement By/ Supv. By	Monitoring Action	Timing	The Deliverable	Contractor's CEE & CSC Reporting on Compliance: what as done, where and when
	Plant Operation and removal and placement of cut and fill materials respectively, including asphalt. Pavement crushing plant **SEE SSEMP ANNEX 9, 11 AND 14**	carried out without a batching plant. Therefore no mitigation is required. II. Slow and controlled mixing of the cement with aggregate to produce concrete shall minimize dust during manual batching for small concrete structure. III. dust during material extraction and movement shall be controlled through transport in batched trucks and watering during dry period. IV. The > 1 million m3 of asphalt-concrete wearing course of the existing road will be totally replaced, requiring the excavation, storage, reprocessing and reuse of the granulated material as road sub-base or recycled for use on secondary roads. Pavement milling/scraping, crushing and reprocessing generates large quantities of dust, which when working with old asphalt-concrete may contain asbestos fibers. Therefore, dust suppression equipment, and protective gear for workers, will be required and at least 10 core samples taken and tested for asbestos fiber content, before any work begins.	the construction period iv. Collect and analyze core samples prior to start of removal of asphaltic layer if asbestos fibers are detected, provide protective clothing and masks to all workers coming contact with removal and crushing work.	material moved, earthworks cutting and filling. iii-all work sites at all times. iv. 12 cores to be taken from all pavement sections and protective gear distributed immediately if asbestos is present.		dust—and if found take immediate action with contractor.	the construction period iv. Collect and analyze core samples prior to start of removal of asphaltic layer if asbestos fibers are detected, provide protective clothing and masks to all workers coming contact with removal and crushing work.	indicating compliance or issue and action taken	
2.2.3	Increase in air pollution from	Emissions will be minimized by: i. ensuring that the contractor's	During the Construction	Construction Site	Contractor/ CSC	Record findings and conduct regular	During the Construction	Inspection Note to file for	

N°	Environment Issue	Mitigative Measures	Time Frame	Location	Implement By/ Supv. By	Monitoring Action	Timing	The Deliverable	Contractor's CEE & CSC Reporting on Compliance: what as done, where and when
	vehicular and machinery exhaust **SEE SSEMP ANNEX 9 & 11**	fleet of vehicles are properly maintained according to manufacturer's specifications; ii. use of appropriate octane fuel and haul loads within specified limits. iii. Vehicle idling time when not in use, limited to no more than 3 minutes, iv. Equipment such as the diesel generator will be included in the emission control program and will be and regularly tuned to prevent excessive temporary pollution.	period			inspections in association with construction supervision	period	use in contractor's reporting and in audit reports.	
2.3	Solid waste management at the construction site **SEE SSEMP ANNEX 4 & 5**	No open incineration of solid waste (garbage) and construction materials shall be permitted on site. All plastics , paper and useable wood will be recycled. Wood scraps can be burned.	During the Construction period	Construction Site	Contractor/ CSC	Record findings and conduct regular inspections in association with construction supervision	During the Construction period	Inspection Note to file for use in contractor's reporting and in audit reports.	
2.4	**Surface and Groundwater**								
2.4.1	**Contamination of Water Resources (Surface & Groundwater)** Surface water can come from leaking fuel storage, liquid bitumen and other chemicals used in rehabilitation works. **SEE SSEMP ANNEX 7 & 8** Groundwater	i. Fuel and oil storage areas should be at least 500m away from watercourses and repair yards to be equipped with an impervious platform, with interceptor traps so that any fuel leakage is retained within the site. ii. All fuel storage sites must be checked daily for leaks and held in an impervious site where spilled/leaking material can be collected. iii. Wash down water from	Throughout the construction period	All construction sites	Contractor / CSC	Regular inspection of work camps, contractors yard, fueling areas , fuel storage	At least monthly throughout the construction period.	Checklist showing the check of fuel and lubricant handling, waste oil management, machinery was down water control, etc. signed and dated--filed. Checklist showing the	

N°	Environment Issue	Mitigative Measures	Time Frame	Location	Implement By/ Supv. By	Monitoring Action	Timing	The Deliverable	Contractor's CEE & CSC Reporting on Compliance: what as done, where and when
	contamination from surface runoff leaking into roadside wells. **SEE SSEMP ANNEX 8**	machinery repair areas to be directed into this system that retains the oil and grease. Refueling not to be permitted within or adjacent to watercourses. Surface water channels crossed by the road will be monitored upstream and downstream of the road before, during and after the work has been completed on that crossing.						check for lighting and signage signed and date filled .	
2.4.2	Interruption / Contamination of Water channels: Movement/drainage of surface water interrupted due to improper culvert construction activities, inadequate diversions and notifications. **SEE SSEMP ANNEX 8 & 13**	i. Contractor should provide the adequate sized diversion, so that there shall be no disturbance to water flows of canal /watercourse. The placement of temporary culverts must avoid scouring and erosion and water leaves the temporary diversion ii. Protection mechanism should be provided to avoid contamination. iii. The land used for the temporary diversion and the water course shall be restored as far as possible to its initial state once the work has been completed	Construction period	Culverts and bridges	Contractor Safety Engineer /CSC	Inspection of diversion along the road, check signage, lighting any leakage etc. at the diversions and rectify through contractor. Ensure contractor has adequately restored temporary work areas.	Construction period	Contractor EHS Officer	
2.5	**Flora and Fauna**								

N°	Environment Issue	Mitigative Measures	Time Frame	Location	Implement By/ Supv. By	Monitoring Action	Timing	The Deliverable	Contractor's CEE & CSC Reporting on Compliance: what as done, where and when
2.5.1	Loss of roadside vegetation and trees **SEE SSEMP ANNEX 10 & 12**	The project requires the cutting of around 4,000 mature trees, for which a plan has been prepared as defined Annex 11, a separate volume This must be fully adhered to and implemented completely by the contractor. Only trees marked for cutting will be removed. All cutting required shall be monitored according to the KR Law "General technical rules and regulations for environmental safety in the Kyrgyz Republic", #151, Clause 12 dtd. 08.05.2009. and the Law of KR "On Protection and Use of Flora", #53 dtd. 20.06.2001. To date tre replanting plans have been prepared for the following sections: 1. Km 15.9-21.3 2. Km 35.5-40.5 3. Km 445.6-51.6 4. Km 54.2-59.35 These must be strictly adhered to When work is finished in anyone area, tree replanting should start, i.e. not waiting until the entire road is completed.	Throughout the construction period when tree cutting is planned	At any locations where mature trees will be cut down.	Contractor/ CSC	-Inspect tree planting and maintenance operation and confirm compliance with mitigation item 2.5.1 and Annex 11 . Also provide ongoing list of tree planting activity	Throughout the construction period when tree cutting is planned	Compliance report, bullet form that mitigation measures are being implemented	
2.6	**Spoil and Solid Waste**								
2.6.1	Inappropriate use of asphalt layers and base materials removed from the existing road .	Demolished asphalt may be re-used in the soft shoulders or as fill for other parts of the rehabilitation works. It may also be used as back-fill for borrow pits and then over-lain with topsoil. Asphalt pieces can be	During Construction	All Construction Sites	Contractor/ CSC	Monitor to check waste handling and disposal procedure of contractor	Throughout construction period	Note to file, signed and dated	

N°	Environment Issue	Mitigative Measures	Time Frame	Location	Implement By/ Supv. By	Monitoring Action	Timing	The Deliverable	Contractor's CEE & CSC Reporting on Compliance: what as done, where and when
	SEE SSEMP ANNEX 7	spread on adjacent roads as surface or pothole fill material and compacted.							
2.6.2	Unused construction material (sand, crush), empty drums, concrete waste and waste from work camps. **SEE SSEMP ANNEX 5 & 7**	i. The contractor will identify dumping locations for construction debris and non-hazardous solid waste with DEP9/Bishkek-Osh and the CSC ii. The contractor shall identify any hazardous waste as part of its health and safety plan and dispose of the material through an approved waste management contractor. iii. The cost of disposal of hazardous (lubricant drums, waste oil, hydraulic fluid, engine filters) and non-hazardous waste shall be included in the Contractors BOQ.	During Construction	All Construction Sites	Contractor /CSC	Monitor to check waste handling and disposal procedure of contractor	Throughout construction period	Note to file, signed and dated	
2.7	**Quarry/Borrow Materials**								
2.7.1	Preservation of Top Soil **SEE SSEMP ANNEX 14**	i. Excavation of earth fill will be limited to an appropriate depth of 20cm. ii. Where deep ditching is carried out, the top half-meter layer will be stripped and stockpiled. iii. The ditch will be filled initially with debris/scrap material from old construction and	During Construction	At any locations where borrow pits, quarries will be operated.	Contract /CSC	iv. Confirm that topsoil has been set aside ii. Check quarry sites for depth.	During Construction period	Written and dated note indicating compliance or issue and action taken. Photo record	

N°	Environment Issue	Mitigative Measures	Time Frame	Location	Implement By/ Supv. By	Monitoring Action	Timing	The Deliverable	Contractor's CEE & CSC Reporting on Compliance: what as done, where and when
		leveled with stockpiled topsoil later. iv. Where borrow pits cannot be fully rehabilitated, landowners will be compensated as provided in agreements between the landowner and contractor.							
2.7.2	Overloading of trucks, may damage pavement, bridges, and culverts	The Contractor will ensure that loaded trucks do not exceed road, bridge and pavement specifications and are checked by weighbridges. The contractor will be required to monitor the transport of material, recording vehicle movements and weights, to be inspected.	Throughout construction period	Construction sites	Contractor's CEE & Safety Engineer/ CSC	Examine weighbridge records and compare to amount of material moved	Throughout construction period	Inspection Note with findings, dated and signed	
2.7.3	Opening of new borrow pits without permit or management plan. **SEE SSEMP ANNEX 14**	If new borrow pit is required contractor will: **1.** Prepare a sketch map of site to be used, access road and volume to be extracted, then seek approval from CSC. **2**. Get approval for the site, based in KR regulation and agreement with landowner; **3.** Open the site by first stockpiling topsoil and securing the area against erosion. **4.** Decommission the site after work is complete, including landscaping and revegetation: 5.Prepare a table showing the 5 actions and notation of what action was taken, sign it and submit to CSC.	Prior to the opening of any new borrow site	At any site where material is take for the road construction, either outside or inside the impact corridor	Contractor/ CSC/IPIG	Confirm documentation prepared as defined in mitigative action No. 2.7.3	Prior to the opening of any new borrow site	Copy of documentation or permit no.	
2.7.4	Risk of erosion and destruction of landscape from side borrow operations.	Side- borrowing along or outside the RoW will not be permitted unless a construction emergency arises, and which will trigger a mandatory consultation with the	Throughout the construction period	Along all 45.1 km of the project road	CEE	Inspect all side borrow activities and establish what permission given, and if none require immediate closure and	Throughout construction period	Permit and relevant documentation on file	

N°	Environment Issue	Mitigative Measures	Time Frame	Location	Implement By/ Supv. By	Monitoring Action	Timing	The Deliverable	Contractor's CEE & CSC Reporting on Compliance: what as done, where and when
	SEE SSEMP ANNEX 14	Environmental Officer of IPIG.				restoration of the site.			
2.8	**Noise**								
2.8.1	Noise associated with earthworks and haul roads. **SEE SSEMP ANNEX 6**	i. Enforcing a speed limit of 30 kph within 500m of any village. ii. Restricting operating hours through roadside villages and settlements to between hours of 0700 and 1800. iii. Large and noisy machinery operations close to urban areas are restricted to daylight hours, and a schedule agreed to between contractor and local communities. iv. CSC to conduct noise monitoring at 12 sensitive sites and during operation of noisy equipment: asphalt breaking and loading, truck haul routes, aggregate crushing, concrete and asphalt production facilities	During Construction period	At 12 sites and varying distances from noisy machinery	CSC and CEE of Contractor/ IPIG-MOTR	Using a portable noise meter, monitor works conditions , and inspect if work conducted within permitted time period in urban zones	During Construction period	Inspection Note to file for use in contractor's reporting with eventual noise measurements.	
2.9	**Health and Safety**								
2.9.1	Damage / disturbance to Utilities within RoW **SEE SSEMP ANNEX 3 & 4**	Removal and relocation of power, water, and other utilities to make way for construction must be conducted through a consultation-first approach, followed by removal and immediate replacement	-At start of construction for the entire 45.1 km--	Along the entire alignment	Contractor / CSC	i. Inspect construction areas where access is an issue and establish if contractor is managing problem and if local residents are satisfied. ii. Always identify by clear signage according to regulation maintenance activities on the roadway	Throughout construction period	Inspection note with findings, dated and signed	

N°	Environment Issue	Mitigative Measures	Time Frame	Location	Implement By/ Supv. By	Monitoring Action	Timing	The Deliverable	Contractor's CEE & CSC Reporting on Compliance: what as done, where and when
2.9.3	Health and Safety Concerns: Protecting the workforce and maintaining a safe working environment. **SEE SSEMP ANNEX 3 & 4**	i. Contractor must provide safety vests, hard hats and protective footwear for all workers handling heavy machinery, and working with hazardous materials such as concrete, asphalt, paints, and cleaning agents . ii. Contractor must provide protective masks to machine operators, where dust can be generated, and to anyone working in the area of the machines, with masks of a micron size, capable of capturing dust down to 2 microns. iii. Any works at night should be adequately lit and high visibility clothing worn and contractor should provide basic training on use of protective clothing and equipment.	Construction period	Contractor's Depots and all work areas, including those of sub-contractor	Contractor's Safety Engineer and CEE / CSC	Inspect all operations in the depots including worker housing and all waste management procedures.	Throughout the construction period	Inspection note re findings, dated and signed.	
2.9.4	Contractor's work areas and depots not maintained, no proper waste management, environmental health and safety measures. **SEE SSEMP ANNEX 3 and 4**	i. All depots shall be provided with septic sanitation facilities and potable water. ii. Monitoring will be required for the solid waste disposal at the depot and to ensure that the health and safety plan based on contract specifications is followed. iii. During operation, the surface of the depot used for storage of construction materials shall be protected against run-off and spills of hazardous materials	Throughout the construction period	Contractor's Depots and all work areas, including those of sub-contractor	Contractor's Safety Engineer and CEE / CSC	CEE and Safety Engineer to conduct regular inspections of sites	Weekly , during the construction period	Inspection checklist addressing three items listed here	

N°	Environment Issue	Mitigative Measures	Time Frame	Location	Implement By/ Supv. By	Monitoring Action	Timing	The Deliverable	Contractor's CEE & CSC Reporting on Compliance: what as done, where and when
		using impermeable protection covering the ground and a system to collect contaminated run-off.							
2.10	Lack of contractor's construction period mitigation completion report	Contractor will be required to prepare a safeguards implementation completion checklist at the end of the construction period, discussing very briefly, each construction period EMP item.	Prior to final payment to contractor	NA	Contractor's CEE and Safety Engineer/ CSC	Inspect and collect report	Prior to final payment to contractor	Copy of report on file	
2.11	Lack of transport and facility for CSC environmental auditor to conduct compliance monitoring.	MOTR must file a semi-annual environmental monitoring report with ADB. Data for that will be assembled based on quarterly environmental inspections by the CSC's environmental specialist. Twice a year the Int'l Env. Specialist will conduct a due diligence compliance audit. To complete this work the CSC Env. Specialist will be provided with transportation as needed, as well as working space in the field	Conduct inspection of all operations every three months, including contractor yard, file semi annual monitoring report and Annual DD audit.	Across the entire construction area , including all subcontractor facilities	CSC and Contractor's CEE/ IPIG	Conduct inspection of all operations every three months, including contractor yard, file semi annual monitoring report and Annual DD audit.	Every three months	Copy of report	
2.12	Failure to protect 12 sensitive site identified in the IEE	The 12-13 sites have been identified in Annex 2 of the IEE and parameter likely impacted identified, plus baseline measurements obtained in 2013 , 2015 and again in 2017. A construction period air, noise and surface water quality testing program will be undertaken quarterly according to the design defined using	Throughout the construction period	AT 12 sensitive sites using the sampling design provided in the IEE-and as specified in CEMP Items 2.4.1, 2.8.1 & 2.8.2	Contractor/ CSC	Examine field survey data on noise, air and surface water quality at sensitive sites	Throughout the construction period	Data tables on file	

N°	Environment Issue	Mitigative Measures	Time Frame	Location	Implement By/ Supv. By	Monitoring Action	Timing	The Deliverable	Contractor's CEE & CSC Reporting on Compliance: what as done, where and when
		GPS coordinates as defined in the in the IEE Annex 2 s.							
3	**Operating Period Contractor's Defect Year**								
3.1	Failure to fully decommission and clean up work area including garbage site, sewage, service area fuels and lubricant spills and erosion protection	Buried garbage, latrine pits, fuel and lubricant and construction material such as bitumen left in and around the contractor's work area will be cleaned up and the area restored.	Within first 3 months of the defect period starting	At contractor offices and housing as well as all other work camps	CEE	Photo inspection/record of before and after	To take place before the end of the 8th month of the defect period	Photo record of before and after rehab. Conditions	
3.2	Contractor abandons used borrow sites leading to illegal mining, erosion and land degradation. **SEE SSEMP ANNEX 14**	Borrow pit restoration according to plan defined in the IEE and earlier in this table, Activity 2.7	Within first 3 months of the defect period starting	At all borrow sites	CEE	CEE to provide photo record of before and after photos	To take place before the end of the 8th month of the defect period	Photo record of before and after rehab. Conditions	
3.3	Haul roads left abandoned not decommissioned leading to inappropriate use, erosion, damage to nearby property. **SEE SSEMP ANNEX 14**	Close road as agreed to with local authorities and local land owners				Record of agreement with local authorities and photo of post-construction road use!	To take place before the end of the 8th month of the defect period	Photo record of before and after rehab. Conditions	
3.4	Inadequate maintenance of large roadside tree plantation **SEE SSEMP ANNEX 10**	Based on MOTR's DEP9 guidance, ensure that trees planted remain healthy, protected from grazing animals and receive water. Annual tree count will be required and any dead trees will need to be replaced.	At the start of the operating period and every two months for the 1st year and semi	All areas where tree planting took place during the construction period	MOTR's highway maintenance unit/MOTR	Inspection of tree plantation and replanting dead trees and re-establishing better maintenance program	3 months before end of defect year	Tree inventory and replanting data sheet	

N°	Environment Issue	Mitigative Measures	Time Frame	Location	Implement By/ Supv. By	Monitoring Action	Timing	The Deliverable	Contractor's CEE & CSC Reporting on Compliance: what as done, where and when
			annually for the next 2 years.						
3.5	Contractor crushing facilities, concrete plant and asphalt plant, especially bitumen storage areas are not cleaned up **SEE SSEMP ANNEX 14**	Contractor to clean up and fully rehabilitate the sites	Within first six months of the defect year	Sites used for the activities defined in column 1	Contractor's CEE	Inspect and record clean up	Within first 6 months of start of operations of the rehabilitated roadway	Inspection record and photo evidence	

ANNEX 4
Revised SSEMP 6 and 7

Revised SSEMP Annex 6: Noise and Vibration

The impacts of noise and vibration in people and structures in the road corridor present a special problem in that hundreds if not thousands of people are potentially negatively impacted in some way. Specialist noise and vibration consultants have developed the following mitigation and monitoring actions. The contractor will be required to apply these measures and, in cooperation with the CSC, monitor their effectiveness and adapt the measures as required in response to unsatisfactory results.

Noise:

1. Construction Period

During the construction period noise within the road corridor Right of Way will be generated almost exclusively be vehicle traffic, with a major contributor being small buses, as well as truck and standard buses.

Noise levels without construction are already around about 10 dBA higher than permissible under KR and IFC/World Bank standards (adopted by ADB). Short of building a noise barrier along much of the corridor, which is totally impractical, speed limit controls and the use of low noise emitting construction equipment and limiting extreme operation of a maximum number of construction equipment at the same time (as defined in the Noise Modelling Report), no other measure is possible.

Therefore during construction the following mitigation measures will be applied:

a) Maintain speed limit at 60 kph by erecting mor speed limit signs and slowing traffic at construction sites; and,

b) IPIG or CSC to instruct the to the contractor that during the day the typical set (as defined in the Noise Modeling Report) should be used as much as possible and that the extreme equipment activity should not be used at night.

c) If construction has to take place at night, contractors must keep construction equipment at twice the normal distance from dwellings during the night as during the day; i.e. double the distance.

These three measures will marginally reduce noise levels, but not enough to really significantly affect the existing construction period noise conditions.

2. Operating Period

Operating period noise in the road RoW will stem from traffic volume growing at around 6-7% per year. In order for traffic noise to audibly increase above construction period levels the traffic volume (assuming a steady fleet composition) will need to double. This is not expected though the 15 year future projections.

Going into the operating period noise levels are already high and exceed basic national and international standards. The optional approach prescribed by ADB has been to use the IFC/World Bank +3 dBA rule. This says that so long as noise levels remain within 3 dBA of the existing condition, namely the start of the operating period, noise levels are in compliance with this formula, and pass ADB’s compliance threshold.

To at least keep noise levels within the +3dBA boundary two mitigative measures were defined by the specialist noise consultant working with the CSC team and will be implemented by the Contractor. They are to:

a) use a special noise attenuation concrete asphalt formulation that significantly reduced the tire noise. That formula is: *Asphalt concrete*

0/11 without gritting (void % 7-8%)-and is predicted to reduce noise levels by about 2 dBA; and,

b) provide ample signage and enforce speed limits to 55 kph except for a short stretch at start of the project road where 75 kph is permitted. This action should lower the noise levels by an average of 0.6 dBA

These two measures combined should lower the noise levels for the more than 4,300 dwellings potentially impacted to within the existing +3dBA formula. Again this measure does little to bring the roadside noise levels down to the level defined by KR and IFC /World Bank as being suited for roadside residential conditions.
Operating period noise monitors is not planned by a program of spot checking will be discussed with the contractor near the end of the main construction period.

Vibration

Based on an in depth analysis of approaches and options, MOTR decided that vibratory compactors will not be used for any construction work, therefore eliminating the project’s vibration problem.

Revised SSEMP-Annex 7 and Addendum

I. Waste Asphalt Management[17]

1. INTRODUCTION

1. In Central Asia, when large scale road pavement rehabilitation work involving pavement replacement takes place, common practice has been to discard the old pavement, mostly by dumping it on the roadside or into empty borrow pits. Besides being aesthetically undesirable and a hazard, the rain leaches out chemicals, contaminating soil, waterways and groundwater. Over the past few decades, Europe and North America have led the way in making maximum use of this 'waste' material by producing recycled asphalt pavement.

2. The US EPA and Federal Highway Administration identified asphalt pavement as the most recycled item in the USA, as early as 1993. It continues to be reclaimed and reused at a greater rate than any other product. A wide range of waste materials are now incorporated into asphalt pavements, including ground tire rubber, slag, foundry sand, glass and recycled asphalt shingles. This recycling saves about 38.3 million m^3 of landfill space each year. Its use in the construction of highways is not only environmentally responsible, but economical and practical with equal or improved pavement performance.

3. Recycled Asphalt usage in pavement reached 74.2 million tons in the USA in 2015 – a 32.5% increase from 2009. An additional 5.5 million tons of Recycled Asphalt Pavement (RAP was used as aggregate. By the end of 2015, some 85 million tons of reclaimed asphalt pavement was stockpiled[18] for future use across the country. More than 99% of asphalt pavement reclaimed from roads and parking lots was intended for use in new pavements instead of going into landfills.

2. IMPLEMENTATION STEPS

4. In order to help local communities, improve their service/access roads or other public spaces, IPIG will authorise the use of old asphalt. While assisting communities by improving their local roads, public spaces and other facilities of their choice, the main goals of these guidelines are to avoid adverse impact on surrounding land, trees and other assets. The majority of people residing in the ayil okmotu along the Project road submitted a request for old asphalt. Each of the requestors needs to be informed about the suggested procedure.

5. The following are the major steps required to help meet the public needs and avoid adverse effects on land and other assets:

- The ayil okmotu/other local authority writes a letter to the IPIG requesting old asphalt. The letter should describe the road/area for which asphalt will be used, its location and ownership status.
- The communities receiving asphalt should submit:
    a. A request letter from the ayil okmotu/other local authority describing briefly where and for what purposes they need asphalt;
    b. Documents/proof (land cadaster map or other appropriate document) showing where asphalt is to be located and what the boundaries are;
    c. If the land is privately held and crops, assets are going to be affected, the owners should be

17 Approved 2017, Update, April 15, 2018 and Addendum Added September 2018

18 If stockpiled, old asphalt pavement should be covered to prevent weathering and leaching of materials into surrounding soils and water supplies.

consulted and sign a statement indicating that they agree with the need for the asphalt, the proposed use of asphalt, and any estimated damage;

d. Where a municipal agreement has been reached and the owners of the land/assets are affected and require appropriate compensation, the contractor and the local authority requesting asphalt, must find an alternative way to compensate affected residents. This must be a written agreement signed by both parties, and sent to the IPIG and Eptisa's environmental and social safeguards specialists;

NOTE: No compensation will be paid from the IPIG compensation funds reserved for the main Project.

6. **Consultations with residents about the proposed work is a step which cannot be avoided.** Without consultations with local residents, no asphalt should be given to any community. EPTISA and the Contractor' environmental and social safeguards **should be invited to observe and facilitate consultations.** A short record from the consultations, including signatures from the participants, decisions and measured agreed, should be included in the minutes from the consultations.

7. Signed consent from all residents living along the proposed area where asphalt will be used, owners and users of the surrounding land and other interested parties must be submitted to the IPIG/EPTISA; The statement should contain the following:

- Details of the requestor;
- Date;
- Location and purpose for the requested asphalt;
- Statement of no objection for the proposed work, signed by all residents living around the area to be asphalted, land owners and other interested parties;
- Description of how the community will ensure that the proposed works will not affect the surrounding land (if private) or affect trees and other vegetation adversely;
- Submit a copy of the residents' consent to the IPIG/EPTISA monitoring specialists;

IPIG/Eptisa will, in collaboration with the Contractor to:

- respond to the communities' requests for waste asphalt;
- make a schedule for the delivery and leveling of the asphalt;
- Inform EPTISA and the Contractor's social and environmental safeguards monitoring specialists on the date, location and time of the delivery of asphalt;
- monitor the activities to ensure that intrusion on private land does not happen, other than what has been agreed to and documented;
- promptly address, record and report on any, oral or written grievances;

3. REVIEW OF STATEMENTS /CLAUSES IN CONSTRUCTION BID DOCUMENT

8. The contract documentation signed by the Contractor contains a number of key commitments that the Contractor is obliged to implement, in order to encourage

better reuse of the old asphalt. The instructions all point to a requirement to crush the asphalt:

a) Removing of Existing Asphalt Pavement

Removed materials of existing asphalt pavement shall be stored at places indicated by the employer or the engineer. The length of removed pavement shall not exceed 5km at a time, in order not to affect traffic and sub-base construction.

From the technical specifications in the contract:

b) Existing Pavements

The existing asphalt concrete layer shall be scarified and removed. The maximum size of the broken asphalt concrete shall be less than 200mm. The removed asphalt concrete shall be brought to spoil areas located and procured by the Contractor and approved by the Engineer.

Re-use of reclaimed pavement materials

The reclaimed pavement materials are expected to be re-used on site, under conditions to be proposed and approved by the Engineer. Re-use of reclaimed asphalt shall follow the rules of EN 13 108-1 or the equivalent GOST standard.

a) Reclaimed unbound material can be re-used:

- in the fill, sub-grade and shoulder layers, after screening of large elements to satisfy the maximum particle size for each specific material, and proof that the unbound mix has properties satisfying the properties for fill and/or sub-grade materials of the present specifications;

- in the crushed stone base, **up to 20% of the total proportion of total aggregates** in the crushed stone base, after screening as above, and introduction of the selected fraction into the crusher with the quarry material for preparation of the crushed stone base. The resulting material has to satisfy the properties of crushed stone base of the present specifications.

b) Reclaimed asphalt material can be re-used after quality testing:

- in the fill, sub-grade and shoulder layers, after screening and crushing in case of cohesive material, to satisfy the grading curve and the maximum particle size for each specific material, up to 20% of the proportion of total aggregates in the mix, and proof that the resulting unbound mix has properties satisfying the properties for fill and/or sub-grade materials of the present specifications;

- **in the asphalt base and binder course, up to 10% of the total proportion of total aggregates** in the asphalt base and binder, after screening, and introduction of the selected material into the asphalt plant with the aggregate for mixing of the asphalt.

4. RECOMMENDATIONS

9. Under the guidance of the IPIG and CSC (EPTISA) the contractor will note the following eight points and implement a full recycled pavement program, securing the necessary equipment to undertake this work:

i. Serious deliberations must take place regarding making the maximum use of this material.
ii. Any waste pavement material must be dumped in an environmentally and socially safe manner as per the strict recommendations of EPTISA's environmental officer and IPIG. Discussions have already been held with district officials to allow the contractor to dispose of waste asphalt at specific locations where local agencies will access and reuse this material for road repair, etc.
iii. Any violations for non-adherence to such recommendations by the contractor(s) will be made good at his risk and cost.

iv. Waste asphalt pavement must be crushed before reuse, a process that is very dusty and noisy. The contractor or a subcontractor will do this and therefore that activity will need to meet strict National Environmental Quality Standards and international best practices, specifically in relation to noise and dust control.
v. The crushing equipment must have operating dust and noise suppression features.
vi. The contractor and or equipment operator must provide adequate PSE equipment to all workers including those feeding the crusher, trucking the material and offloading, and backhoe operators handling the crushed materials. The PSE equipment should include dust masks able to capture 2.5-micron particles, over-the-ear noise protection and eye protection for machinery operators.
vii. The Contractor's Environmental Monitor and EPTISA will be required to inspect PSE usage weekly and remind contractors to enforce its use in the work area.
viii. The Contractor's Environmental Monitor will be required to indicate the results of this inspection in a weekly note to EPTISA, as long as the crushing goes on.

Addendum-Sept 2018[1]

II. Handling and Transport of Waste Asphalt to 89 Local Roads

The field inspection of September 10th, 2018 indicated that the contractor was following the general guidelines provided in this Annex and as defined in the CEMWP for the project. Therefore, this addendum provides a summary of the approach being taken by the contractor and acts as more of a reminder and checklist of the best practice approach to the transport and placement of the waste asphalt.

1. BACKGROUND

The total replacement of the asphalt along 45.5 km or the Bishkek to Kara Balta section of National Highway No.1 requires the disposal and/or reuse of more than 490,000.00 m^3 of asphalt removed from the highway. In the contract with the construction contractor a general disposal arrangement was defined, indicating that waste asphalt would be crushed into pieces no larger than 0.2 m^2 and stored in government approved sites for reuse[19].
Initially the contractor was not able to crush the waste asphalt, but instead wanted to simply dump large slabs and storage sites. Further, the contractor could get approval for the disposal of the waste asphalt as long as it was larger than 0.2m^2 around 0.4-0.8 $m^{2,}$, considerably larger than specified in the construction contract.

In mid 2018 IPIG and the contractor made arrangements with seven municipal governments who allowed the placement of crushed asphalt to a maximum of 0.2 m^2 to be place on 88 secondary roads (Table **37Ошибка! Источник ссылки не найден.**), or stored along these roads for future rehabilitation work. Since this disposal approach is not according to the contract and not specifically assessed in the IEE, the Environmental Management Plan or its Site Specific Environmental Management Plan (SSEMP)(Annex 7) dealing with waste asphalt disposal.
To address this gap EPTISA, on behalf of IPIG, has completed a field survey on four representative roads (Figure **22**) of the 88 to receive waste asphalt, identified potential impacts and specified best practice mitigation measures in a matrix table (Table 38).

19 In Clause 3.5.5 of the construction contract the maximum crushed asphalt size is specified as 0.2m2.

Consultation with Local Communities
The SSEMP-Annex 7 provides a detailed set of steps needed to insure that local communities and residents along the 88 road to receive material are informed of the actions, understand the impact and agree with action. This consultation is in addition to the consents given by the government officials, namely :

- a consent letter from local authorities to the IPIG requesting old asphalt, and describing the road/area where asphalt will be deposited, its location and ownership status.

The communities receiving asphalt should submit:

- a request letter to the local authority describing briefly where and for what purposes they need asphalt;
- documents/proof (land cadaster map or other appropriate document) showing where asphalt is to be located and what the boundaries are.

Before placement can take place. local residents along the roads receiving the asphalt need to provide signed no-objection notes to the local authorities,

If the land is privately held and crops and assets could be affected, the owners must be consulted and then sign a statement indicating that they agree with placement plan and to any estimated damage set by the local authority; This must be a written agreement signed by both parties, and sent to the IPIG and EPTISA's environmental and social safeguards specialists;

2. CONSTRUCTION ACTIVITIES, IMPACTS AND MITIGATION

Asphalt crushing
Waste asphalt and a portion of the subgrade gravel was removed from the highway using backhoes (not other heavy equipment was used). The material up to 0.8m^2 was loaded onto the contractor's trucks and transported to the designated roads Once deposited it was crushed by passes from a large bulldozer, resulting in pieces generally no larger than 0.2 m^2 (Figure **21**). The asphalt slabs were removed with enough subgrade gravel that the combination created a relatively smooth road surface (Figure **22**), i.e. a mixture of crushed asphalt and gravel.

Figure 21. Close up of size of larger waste asphalt pieces; approximately 10cm x 5cm, which is crushed to a much smaller size after several bulldozer passes

Materials Transport and Deposition

Material transport and deposition by the contractor (or sub contractors) triggers five potential impact that can be prevented. These are:

1. excessive haul road dust and noise;
2. dumping of materials outside designated road boundaries or at unapproved

stockpiling sites
3. Damage to roadside trees due to inappropriate placement
4. Blockage of surface drainage and culverts due poor placement of materials or damage to existing culverts due to overloaded trucks an inappropriate use of heavy equipment
5. Blockage or serious impedance of access by local residents to the road receiving waste asphalt or the main highway

Contamination of Surface Runoff Water From Waste Asphalt

The runoff coming from recently placed crushed asphalt is a function of the type or road use and traffic over time, and condition of the vehicle fleet using the road. Aside from lead in leachate water, runoff from waste asphalt stockpiles and roads has been determined to be generally chemically benign (Townsend, 1998) as long as the runoff is unobstructed and is not allowed to empty directly into an receiving water, without passing over a grassed drainage area or through a detention pond or sump, The only other concerns the fine grains washed out by precipitation and contributing to suspended sediment levels in local runoff streams.

3. STEPS BEING TAKEN BY CONTRACTOR

Based on a field visit involving the inspection of four road that have already received waste asphalt, a day-long interview with the contractor's specialist organizing the waste asphalt deposition (participating in the field trip), and detailed documentation of the procedure being followed, the following summary is proved.

1) The contractor sent a letter to 7 municipalities that the road passes through, asking for a list of roads where waste asphalt might be needed.
2) Municipalities responded with 200 candidate roads, indicating specific needs, e.g. flood control, traffic bypasses, better farm access, etc.
3) Given the amount of material, the work required by the contractor and time available, the contractor discussed the list with each of the 7 municipalities and a list of 89 roads was established (Table). All of these 'roads' were existing tracks, farm roads or abandoned past access roads.
4) For each of these roads the contractor received an agreement letter and assurances from the municipal/local authority that the roads were on public land.
5) For transport and placement of materials, local officials were contacted and were always present on site to direct the placement, insuring that placement was as required by the local authority.
6) The contractor trucked in the material which contained waste asphalt, but also subbase gravel and sand, resulting in a more stabile and smoother surface (Figure **22**).
7) Given that many pieces arriving from the highway were large, the contractor uses bulldozers to crush the material and grade the roadway. Often I larger pieces were left at the edge of the roadway, which the authorities accepted. IN some cases local residents used these larger pieces to improve their driveways.

For the 10 roads worked on to date, the time required to complete one road has ranged between 6-14 days and deposit volumes have ranged from 300-4,000 m^3 of material or between 15 and 200 truckloads.

These seven steps clearly indicate that the contractor is avoiding the potential impacts listed above by careful planning, cooperation with the local authorities and adhering to the steps defined in this SSEMP (Annex 7) of the IEE.

So far there have been no complaints by local residents, who in fact have universally welcomed the local road improvements.

Figure 22. Six examples of waste asphalt and subgrade gravel placed on rural roads by the contractor. Transport placement and grading usually took 6-14 days.

4. SSEMP MITIGATION AND MONITORING MATRIX FOR WASTE ASPHALT PLACEMENT

Table 38 lists a set of mitigation measures, as a reminder of what the contractor is already doing and what needs to be adhered to as the asphalt placement on the remaining 79 roads is undertaken over the next year.
When additional roads are selected the same process will be undertaken and monitored by the CSC.

Table 37.Basic Statistics For 88 Road To Receive Waste Asphalt. Volume Is Estimate As Avg Width 6m x Road Length x avg Depth 30 cm.

Point	Road No. As Shown on Google Maps	Name of area	Name of approving community	Date of approval	Width of road with asphalt placed	Length subject to processing L	Est. Total vol. Delivered (m^3) W x L x D	Distance: Source to Rural Road (approx)	Average size crushed material after placement
Road Name	№	Name	Name	dd/mm/yy	m	m	m^3	km	cm2
Futbolnaya	1	**Sokuluk**	Gavrilovka r/a	05 - 07 /2018	5-7	1200	2160	0.8	0.1-0.3
Zaboykalskaya	2	Sokuluk	Gavrilovka r/a	05 - 07 /2018	5-7	500	900	0.8	0.1-0.3
Gorky	3	Sokuluk	Gavrilovka r/a	05 - 07 /2018	5-7	1500	2700	1	0.1-0.3
Yujnaya	4	Sokuluk	Gavrilovka r/a	05 - 07 /2018	5-7	2000	3600	1	0.1-0.3
Shkolnaya	5	Sokuluk	Gavrilovka r/a	05 - 07 /2018	5-7	1000	1800	0.8	0.1-0.3
Drujba	6	Sokuluk	Gavrilovka r/a	05 - 07 /2018	5-7	700	1260	1	0.1-0.3
Olimpiyskaya	7	Sokuluk	Gavrilovka r/a	05 - 07 /2018	5-7	450	810	1.1	0.1-0.3
Severnaya	8	Sokuluk	Gavrilovka r/a	05 - 07 /2018	5-7	450	810	1.3	0.1-0.3
Turgeneva	9	Sokuluk	Gavrilovka r/a	05 - 07 /2018	5-7	300	540	1	0.1-0.3
Pushkina	10	Sokuluk	Gavrilovka r/a	05 - 07 /2018		not required			
Zapadnaya	11	Sokuluk	Gavrilovka r/a	05 - 07 /2018	5-7	1000	1800	0.8	0.1-0.3
K.Marksa	12	Sokuluk	Gavrilovka r/a	05 - 07 /2018	5-7	2000	3600	1.2	0.1-0.3
Polevaya	13	Sokuluk	Gavrilovka r/a	05 - 07 /2018	5-7	1500	2700	1	0.1-0.3
Pionerskaya	14	Sokuluk	Gavrilovka r/a	05 - 07 /2018	5-7	700	1260	1	0.1-0.3
Komsomolskaya	15	Sokuluk	Gavrilovka r/a	05 - 07 /2018	5-7	500	900	1	0.1-0.3
Naberejnaya	16	Sokuluk	Gavrilovka r/a	05 - 07 /2018	5-7	400	720	0.8	0.1-0.3
Housing estate Yntymak	17	Sokuluk	city hall of Shopokov city	05 - 07 /2018	5-7	4000	7200	1.5	0.1-0.3
Lugovaya	18	**Moscow**	Petrovka r/a	05 - 07 /2018	5-7	950	1710	0.8	0.1-0.3
Zavodksaya	19	Moscow	Petrovka r/a	05 - 07 /2018	5-7	300	540	0.8	0.1-0.3
141 crossing	20	Moscow	Petrovka r/a	05 - 07 /2018	5-7	2000	3600	0.5	0.1-0.3

Point	Road No. As Shown on Google Maps	Name of area	Name of approving community	Date of approval	Width of road with asphalt placed	Length subject to processing L	Est. Total vol. Delivered (m^3) W x L x D	Distance: Source to Rural Road (approx)	Average size crushed material after placement
Besh Terek	21	Moscow	Petrovka r/a	05 - 07 /2018	5-7	500	900	0.7	0.1-0.3
Lomonosova	22	Moscow	Petrovka r/a	05 - 07 /2018	5-7	1000	1800	0.8	0.1-0.3
Krasnoarmeiskaya	24	Moscow	Belovodskoe r/a	05 - 07 /2018	5-7	2700	4860	0.8	0.1-0.3
Zorge	25	Moscow	Belovodskoe r/a	05 - 07 /2018	5-7	400	720	1.2	0.1-0.3
Lenina	26	Moscow	Belovodskoe r/a	05 - 07 /2018	5-7	500	900	1	0.1-0.3
Zheleznodorojnaya	27	Moscow	Belovodskoe r/a	05 - 07 /2018	5-7	1900	3420	1	0.1-0.3
Gaidara	28	Moscow	Belovodskoe r/a	05 - 07 /2018	5-7	800	1440	1	0.1-0.3
Shorsa	29	Moscow	Belovodskoe r/a	05 - 07 /2018	5-7	1800	3240	0.8	0.1-0.3
Krasina	30	Moscow	Belovodskoe r/a	05 - 07 /2018	5-7	800	1440	0.8	0.1-0.3
Shkolnaya	31	Moscow	Belovodskoe r/a	05 - 07 /2018	5-7	700	1260	0.6	0.1-0.3
Ukrainskaya	32	Moscow	Belovodskoe r/a	05 - 07 /2018	5-7	1100	1980	0.8	0.1-0.3
Moskovskaya	33	Moscow	Belovodskoe r/a	05 - 07 /2018	5-7	700	1260	0.5	0.1-0.3
Tokombaeva	34	Moscow	Belovodskoe r/a	05 - 07 /2018	5-7	700	1260	0.5	0.1-0.3
Tuleberdieva	35	Moscow	Belovodskoe r/a	5 - 07 /2018	5-7	300	540	0.7	0.1-0.3
Ryabova	36	Moscow	Belovodskoe r/a	5 - 07 /2018	5-7	300	540	1	0.1-0.3
Lugovaya	37	Moscow	Belovodskoe r/a	5 - 07 /2018	5-7	1700	3060	1.2	0.1-0.3
Lunacharskogo	38	Moscow	Belovodskoe r/a	5 - 07 /2018	5-7	200	360	1	0.1-0.3
Leningradskaya	39	Moscow	Belovodskoe r/a	5 - 07 /2018	5-7	200	360	1.3	0.1-0.3
Gorkogo	40	Moscow	Belovodskoe r/a	5 - 07 /2018	5-7	500	900	0.8	0.1-0.3
Komsomolskaya	41	Moscow	Alexandrovka r/a	5 - 07 /2018	5-7	3500	6300	0.7	0.1-0.3
Pionerskaya	42	Moscow	Alexandrovka r/a	5 - 07 /2018	5-7	2000	3600	0.7	0.1-0.3
Frunze - Zapadnaya	43	Moscow	Alexandrovka r/a	5 - 07 /2018	5-7	500	900	0.7	0.1-0.3

Point	Road No. As Shown on Google Maps	Name of area	Name of approving community	Date of approval	Width of road with asphalt placed	Length subject to processing L	Est. Total vol. Delivered (m^3) W x L x D	Distance: Source to Rural Road (approx)	Average size crushed material after placement
Frunze - Tashkentskaya	44	Moscow	Alexandrovka r/a	5 - 07 /2018	5-7	500	900	0.8	0.1-0.3
Frunze - Mamaiskaya	45	Moscow	Alexandrovka r/a	5 - 07 /2018	5-7	1000	1800	0.8	0.1-0.3
Frunze - Pochtovaya	46	Moscow	Alexandrovka r/a	5 - 07 /2018	5-7	800	1440	1	0.1-0.3
Frunze - Masanchina	47	Moscow	Alexandrovka r/a	5 - 07 /2018	5-7	1000	1800	1	0.1-0.3
Frunze - Oktyabrskaya	48	Moscow	Alexandrovka r/a	5 - 07 /2018	5-7	500	900	1	0.1-0.3
Frunze - Tatarskaya	49	Moscow	Alexandrovka r/a	5 - 07 /2018	5-7	600	1080	1	0.1-0.3
Frunze - Vonahuna	50	Moscow	Alexandrovka r/a	5 - 07 /2018	5-7	500	900	1	0.1-0.3
Frunze - Lugovaya	51	Moscow	Alexandrovka r/a	5 - 07 /2018	5-7	600	1080	0.9	0.1-0.3
Stepnaya	52	Moscow	Sadovoe r/a	5 - 07 /2018	5-7	900	1620	1.1	0.1-0.3
Shevchenko	53	Moscow	Sadovoe r/a	5 - 07 /2018	5-7	400	720	1.1	0.1-0.3
Kavkazskaya	54	Moscow	Sadovoe r/a	5 - 07 /2018	5-7	1200	2160	1.2	0.1-0.3
D.Bednogo	55	Moscow	Sadovoe r/a	5 - 07 /2018	5-7	1000	1800	1	0.1-0.3
Parkovaya	56	Moscow	Sadovoe r/a	5 - 07 /2018	5-7	800	1440	1	0.1-0.3
Beregovaya	57	Moscow	Sadovoe r/a	5 - 07 /2018	5-7	300	540	0.8	0.1-0.3
Tyshenko	58	Moscow	Sadovoe r/a	5 - 07 /2018	5-7	500	900	0.9	0.1-0.3
Lugovaya	59	Moscow	Sadovoe r/a	5 - 07 /2018	5-7	900	1620	0.8	0.1-0.3
Stroitelnaya	60	Moscow	Sadovoe r/a	5 - 07 /2018	5-7	800	1440	0.8	0.1-0.3
Ukrainskaya	61	Moscow	Sadovoe r/a	5 - 07 /2018	5-7	800	1440	0.5	0.1-0.3
Birimdik	62	Moscow	Sadovoe r/a	5 - 07 /2018	5-7	800	1440	1.2	0.1-0.3
Yntymak	63	Moscow	Sadovoe r/a	5 - 07 /2018	5-7	800	1440	1.3	0.1-0.3

Point	Road No. As Shown on Google Maps	Name of area	Name of approving community	Date of approval	Width of road with asphalt placed	Length subject to processing L	Est. Total vol. Delivered (m^3) W x L x D	Distance: Source to Rural Road (approx)	Average size crushed material after placement
Toktogula	64	Moscow	Sadovoe r/a	5 - 07 /2018	5-7	900	1620	0.9	0.1-0.3
O.Koshevogo	65	Moscow	Sadovoe r/a	5 - 07 /2018	5-7	400	720	0.8	0.1-0.3
Sitnikova	66	Moscow	Sadovoe r/a	5 - 07 /2018	5-7	800	1440	0.8	0.1-0.3
Vostochnaya	67	Moscow	Sadovoe r/a	5 - 07 /2018	5-7	600	1080	0.7	0.1-0.3
Kolhoznaya	68	Moscow	Sadovoe r/a	5 - 07 /2018	5-7	300	540	0.5	0.1-0.3
Notrh side BCK	69	Moscow	Sadovoe r/a	5 - 07 /2018	5-7	600	1080	0.5	0.1-0.3
Gorkogo	70	**Jayil**	Poltavka r/a	5 - 07 /2018	5-7	800	1440	1	0.1-0.3
Kominterna	71	Jayil	Poltavka r/a	5 - 07 /2018	5-7	700	1260	1	0.1-0.3
Partizanskaya	72	Jayil	Poltavka r/a	5 - 07 /2018	5-7	500	900	2	0.1-0.3
Komsomolskaya	73	Jayil	Poltavka r/a	5 - 07 /2018	5-7	1200	2160	1.2	0.1-0.3
end of Ortosuu village	74	Jayil	Poltavka r/a	5 - 07 /2018	5-7	700	1260	0.9	0.1-0.3
AVM district	75	Jayil	Poltavka r/a	5 - 07 /2018	5-7	1200	2160	0.7	0.1-0.3
Klyuchevaya	76	Jayil	Kyzyl Dyikan r/a	5 - 07 /2018	5-7	500	900	0.7	0.1-0.3
Frunze	77	Jayil	Kyzyl Dyikan r/a	5 - 07 /2018	5-7	500	900	1.1	0.1-0.3
Sovetskaya	78	Jayil	Kyzyl Dyikan r/a	5 - 07 /2018	5-7	800	1440	0.5	0.1-0.3
Shkolnaya	79	Jayil	AkBashat r/a	5 - 07 /2018	5-7	2000	3600	0.5	0.1-0.3
Zelenaya	80	Jayil	AkBashat r/a	5 - 07 /2018	5-7	1000	1800	0.6	0.1-0.3
Lugovaya	81	Jayil	AkBashat r/a	5 - 07 /2018	5-7	800	1440	0.8	0.1-0.3
Yujnaya	82	Jayil	AkBashat r/a	5 - 07 /2018	5-7	900	1620	0.7	0.1-0.3
Krupskaya	83	Jayil	AkBashat r/a	5 - 07 /2018	5-7	800	1440	0.8	0.1-0.3
D.Bednogo	84	Jayil	AkBashat r/a	5 - 07 /2018	5-7	1000	1800	0.8	0.1-0.3
Novoselskaya	85	Jayil	AkBashat r/a	5 - 07 /2018	5-7	400	720	0.8	0.1-0.3
Novosadovaya	86	Jayil	AkBashat r/a	5 - 07 /2018	5-7	500	900	0.9	0.1-0.3

Point	Road No. As Shown on Google Maps	Name of area	Name of approving community	Date of approval	Width of road with asphalt placed	Length subject to processing L	Est. Total vol. Delivered (m^3) W x L x D	Distance: Source to Rural Road (approx)	Average size crushed material after placement
Moskovskaya	87	Jayil	AkBashat r/a	5 - 07 /2018	5-7	500	900	0.5	0.1-0.3
Field Road after Jelamysh Bridge	88	Sokuluk	Gavrilovka r/a	5 - 07 /2018	5-7	1900	3420	0.2	0.1-0.3
Total							142,650.00		

Note: roads in red font inspected during Sept. 2018 field visit and photos included (Figure **22**)

The impacts listed two activities need improvement:

a) Inspection and repair of any blockage or damage to converts and other conveyances under roads receiving waste asphalt; and,
b) Provision of assistance to roadside residents to unblock access to the road, by helping to remove asphalt pieces and crushing and placing as requested by the roadside resident.

To assess the threat of lead entering the in the local ecosystem, and especially leaching into ground water supplies, a set of 4 replicate samples will be taken at fou roads during the first major rain event and water will be tested for lead content. If significant the measures defined in Table 38 will be implemented by Contractor and taken over by the local authority after the defect period.

The contractor and EPTISA’s monitors will continue to check the progress of this work and provide a photo record of completed roads and conduct a number of interviews with local authorities to obtain feedback on the job done.

The contractor must adhere to these measures and EPTISA’s environmental monitoring will check compliance by applying the monitoring measures, using the compliance monitoring checklist template included in this SSEMP.

Table 38.Waste Asphalt Management SSEMP matrix. Potential impacts, mitigation and monitoring actions on 88 rural roads.

Mitigation Category	Mitigation measure	Action	When	Who	Observations
Boundary Determination	Boundary for all waste asphalt deposit	Local authority to provide boundary for all waste asphalt deposits, including stockpiles	Prior to start of transport of materials	IPIG working with contractor and local authority	These data have been provided by local authorites who are in site when/where the work takes palce
Consultation	Consent letter for waste asphalt deposit	IPIG and Contractor to Obtain consent letter from community official.	Prior to Start of Transport of materials	IPIG & Contractor	This is being done and written records are maintained in most cases
	Request for asphalt from local community	Contractor to obtain official request for waste asphalt deposition from local communities	Prior to Start of Transport of materials		
	Road/deposit site ownership	Confirmation of legal ownership of road; i.e. public and private via ownership document	Prior to Start of Transport of materials		
	No objection to asphalt placement from roadside residences	Request written no objection notes from roadside residents agreeing to the project	Prior to Start of Transport of materials		
	Compensation for impact on privately held land	Define & agree to compensation mechanism and amount with each affected person, family or business.	Proir to start of construction work		All roads are on public lands, confirmed by local officials on the scene
Asphalt Transport and Deposition	Haul road dust control	Watering	During work	contractor	This is being done as needed
	Post-haul road use rehabilitation and necessary repair	Contractor has agreed with local authorities to repair all damage due to heavy truck roads on highways lead to the target roads	During work	Contractor	So far contractor has kept truck loads design tonnage limits of the access roads.
	Deposits kept within pre-determined boundaries	Local authority to be on site when work begins and directs deposit	At all times	Contractor and local authority	For the ten roads already completed, this process has been successfully implemented.
	Avoiding damage to roadside trees	Contractor is not authorised to cut or push over any trees	At all times	IPIG and EPTISA will enforce this	To this point deposits have been within a road allowance avoiding any

Mitigation Category	Mitigation measure	Action	When	Who	Observations
					damage or compaction for roadside trees
	Preventing surface water drainage blockages	Insure that surface water drainage form newly surfaced road is maintained and that culverts are not blocked or by the deposits, or damaged by heavy equipment.	At all times	Inspection by the contractor once work is completed	This task needs improvement since blockage of culverts, along the single road where a culvert existed was evident.
	Avoiding access restrictions for roadside residents	Contractor must clear local access/driveways of waste asphalt pieces as the work is proceeding	At all times	Contractor with local authority present	This task is not being done well and , during the field visit, local resident were seen clearing their driveway access.
Surface Water Runoff	Management of lead leachate from waste asphalt deposits.	It is likely that first rains on the newly places crushed asphalt could result in low concentrations of lead, leaching from the asphalt due to the lead additive in petrol for so many decades, embedded on the asphalt and sub base gravels. To examine and establish some knowledge, one water sample from 4 roads during precipitation events will be taken once and tested for lead. Should lead be found, runoff from these roads must be detained either in grassed ditches or small detention basins allowing for any lead to settle out before discharge to streams. During the dry season these detention basins need to be cleaned or covered with earth to prevent the dust and lead from	During a first rain event on the newly covered road	Contractor and EPTISA	The licely concentrations of leached lead

Mitigation Category	Mitigation measure	Action	When	Who	Observations
		becoming airborne.			

See: https://www.fhwa.dot.gov/publications/research/infrastructure/structures/97148/rap135.cfm for additional details.

ANNEX 7a
Photos Of Three Bridge Construction Sites

Jelamysh Bridge construction

Ak Suu Bridge Site

Sokuluk River bridge Construction site, June 2018

Hagler Bailly Pakistan

Central Asia Regional Economic Cooperation Corridor 3

Noise Modeling of 45.1 km Section of the Bishkek-Kara Balta Section of the Bishkek-Osh Road Baseline, Construction and Operating Period

Hagler Bailly Report

D7I05BOR
April 16, 2018

and EPTISA April 26, 2018

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Acronyms

AH	Adobe House
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
SBH	Slag Block House
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 Bishkek-Kara Balta Section (the "Project" or "Project road") of the Bishkek-Osh Road is 45.1 kilometer (km) long. It starts at the end of the administrative limits of Bishkek city and ends on the outskirts of Kara Balta (see **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 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 45.1 km (KM15.9 to KM61.0) 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.

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

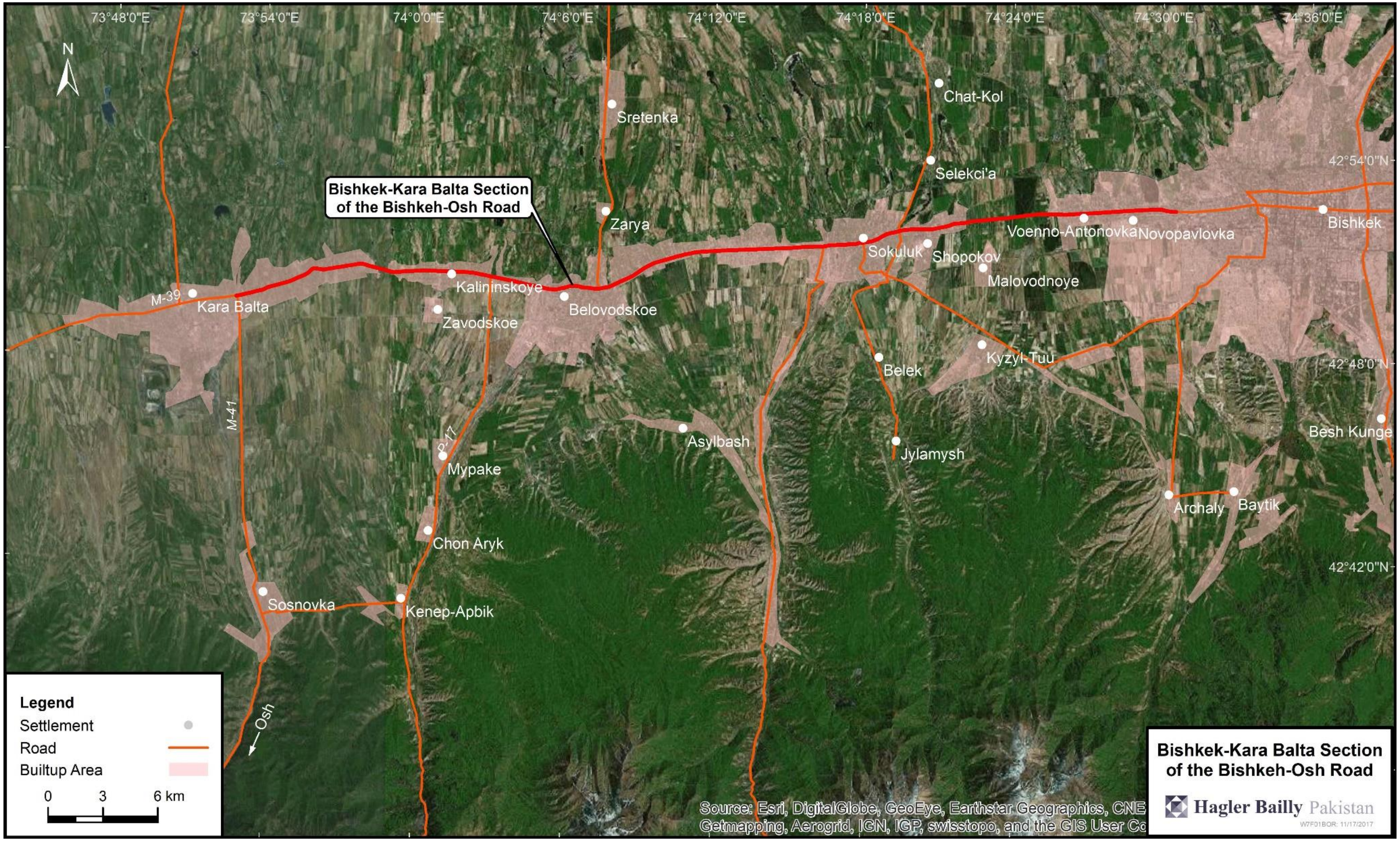

Figure 1.1: Project Location

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.

1.2 Baseline Noise Levels

9. The baseline noise levels already exceed the Kyrgyz and IFC day and nighttime limit by an average of 13 dBA and 17 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	

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

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 stages C and D by an average of 1 dBA, respectively during the construction period. The nighttime noise levels exceed in all stages. During nighttime the levels exceed by an average of 1.5 dBA, 3.3 dBA, 5.2 dBA and 1.7 dBA in stages A, B, C and D, respectively.

Table 1.2: Construction Period Increment over Baseline; Typical Configuration (dBA)

Year	Stage A		Stage B		Stage C		Stage D	
	Day	Night	Day	Night	Day	Night	Day	Night
2018	1.8	4.4	2.2	5.2	3.9	8.1	1.9	4.6
2019	1.9	4.5	2.3	5.3	4.0	8.2	2.1	4.7
2020	2.1	4.6	2.5	5.4	4.1	8.2	4.3	4.9

13. **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 0.5 dBA, 1.2 dBA, 3.8 dBA and 0.9 dBA in stages A, B, C and D, respectively. During nighttime the levels exceed by an average of 4.3 dBA, 5.5 dBA, 8.7 dBA and 5.0 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	7.2	4.1	8.5	6.7	11.6	3.8	7.9
2019	3.5	7.3	4.2	8.5	6.8	11.7	3.9	8.0
2020	3.6	7.4	4.3	8.5	6.8	11.7	4.0	8.0

1.3.2 Operation Noise Impacts

14. 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 are presented in **Table 5.4** of the report.

15. The operational noise levels in 2025, 2030 and 2035 at selected receivers are in compliance with IFC guideline of baseline + 3 dBA.

16. 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. There are total of 4 and 135 structure that are non-compliant during day and night, respectively.

1.4 Suggested Mitigative Measures and Monitoring Actions

17. 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

18. 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 (last resort and if complaints are filed).
- **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

19. Two mitigation options were considered as per Client instruction to achieve compliance in year 2035. These were:

- **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:
  - Asphalt concrete 0/11 without gritting (void % 7-8%)
  - Porous asphalt; pores >15% 0/11

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[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:
  - KM15.9-KM19.0 75 km/h
    KM19.0-KM61.0 55 km/h
  - KM15.9-KM19.0 70 km/h
    KM19.0-KM61.0 50 km/h

20. To bring future noise levels in line with the baseline +3 dBA IFC standard, the use of noise attenuating asphalt (Asphalt concrete 0/11 without gritting [7-8% voids]) and a speed limit of less than 70 kph, but preferably ≥ 60 kph would ensure an acceptable noise environment for all future forecast years through 2035.

1.5 Recommendations

21. It is recommended that construction be avoided during nighttime as the nighttime noise levels during on-going construction work exceed the IFC guideline of baseline + 3 dBA by 5.2 dBA and 8.7 dBA, during Typical and Extreme Configurations, respectively. If work must be undertaken at night, then "Typical Configuration" should be the prevailing configuration, plus the suggested mitigation measures.

22. For the operating period, the noise attenuating pavement option is recommended over the speed reduction option as people may over speed even after applying speed limits resulting in noise levels exceeding the standards. Also the modified pavement is enough to keep the noise within the IFC formula. Also, the highway is made for the purpose of providing high speeds to the users and to reduce the travelling time. If the speed reduces to around 50 km/h then the purpose of the highway is not be served.

2 Introduction

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 Bishkek-Kara Balta Section (the “Project” or “Project road”) of the Bishkek-Osh Road is 45.1 kilometer (km) long. It starts at the end of the administrative limits of Bishkek city and ends on the outskirts of Kara Balta (see Figure 2.1).

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.

2.1 Key Terminology

3. 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 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 *KM15.9* and ends at *KM61.0*.
- **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.

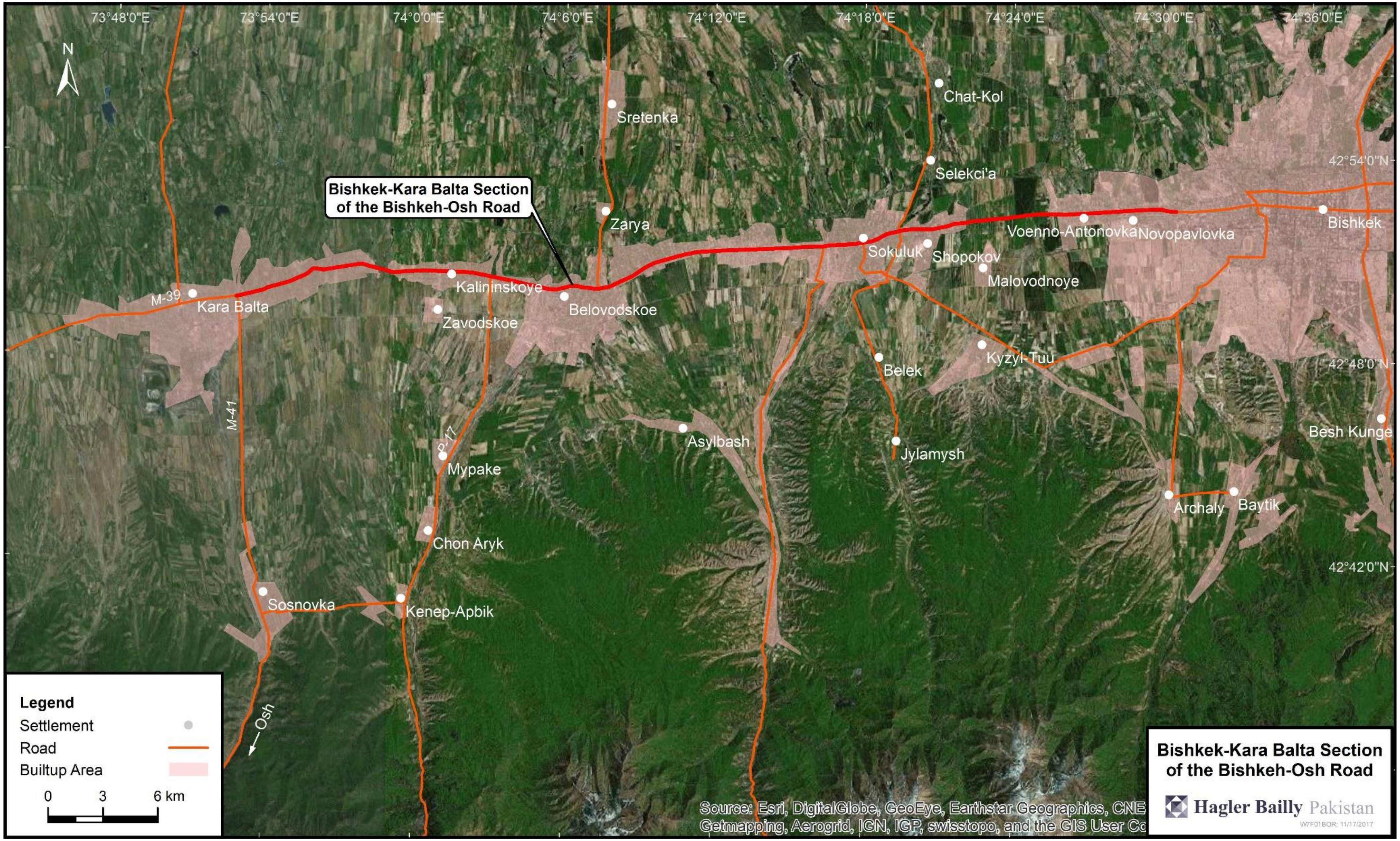

Figure 2.1: Bishkek-Kara Balta Section of the Bishkek-Osh Road

- **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

4. **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.

5. 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.

6. 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**) states that *noise impacts should result in a maximum increase in background levels of 3 dBA at the nearest receptor location off-site.*

7. 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.

8. 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

9. Consistent with the ToRs, the scope of this study focuses on the front row receptors along the road corridor starting from KM15.9 to KM61.0. The analysis to be undertaken included:

- Simulated noise baseline for all front row dwellings along 45.1 km road; baseline modeling and baseline day and nighttime contours
- Construction noise levels along the 45.1 km road; construction phase modeling and construction phase daytime contours
- Operational noise levels along the 45.1 km road without mitigation; operation phase modeling and operation phase day and nighttime contours
- Operational noise levels with mitigation options as low noise pavements and lower speeds
- Complete noise modeling report including executive summary

2.4 Modeling Approach

10. 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".

11. 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.

12. 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.

13. 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

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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

using the 2017 traffic and growth rate provided by the Client. The compliance is checked for the year 15 (2035).

14. The outputs provided are as follows:
    - Baseline (noise levels of selected receivers and day and nighttime noise isopleths)
    - Construction phase (noise levels of selected receivers and daytime noise isopleths)
    - Operation phase after 5 years (noise levels of selected receivers)
    - Operation phase after 10 years (noise levels of selected receivers)
    - Operation phase after 15 years (noise levels of selected receivers and day and nighttime noise isopleths with and without mitigation)

2.5 Objectives of the Report

15. This report aims to provide:
    - The specific details of the noise model used for this study;
    - The assumptions made on the variables;
    - The simulated noise baseline from current traffic and road conditions;
    - The construction noise levels;
    - The 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

16. The noise model, SoundPLAN Essential Version 4.0 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

17. 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 °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 maximum number of floors were selected for the receiver noise levels. The

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

Parameter	Description
	receivers were placed at the front side of the structure facing the road. **Table 3.2** provides the details of selected receivers.
Structure	All the front row digitized structures were provided by the Client which were first geo-referenced and then imported to the model as DXF. The structures are as follows: • Adobe House (AH) • Brick House (BH) • Non-dwelling (ND) • Steel Non-dwelling (SND) • House Under construction (HUC) • Slag Block House (SBH) • School • Mosque • Shed • Container • Garage • Petrol Station • Police Station 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.

[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.

Parameter	Description
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 is divided in three traffic zones as below: • Traffic Zone I (most traffic): Bishkek (KM9.0) – Sadove (KM35.0) • Traffic Zone II (moderate traffic): Sadove (KM35.0) – Poltavka (KM53.0) Traffic Zone III (least traffic): Poltavka (KM53.0) – Kara Balta (KM61.0)

[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	Building Use	Floors	Distance from Road Centerline	Traffic Zone
1	26.2	442402.4	4745173.3	No. 132	BH	4	33	I
2	26.5	442146.8	4745142.9	No. 136	BH	3	52	I
3	26.0	442596.5	4745209.8		BH	3	45	I
4	25.6	443032.6	4745343.8	No.135	BH	3	37	I
5	25.7	442938.7	4745224.1		BH	3	65	I
6	25.9	442701.8	4745242.3	No. 126a	BH	3	21	I
7	30.3	438332.1	4744896.1		BH	3	70	I
8	32.0	436597.9	4744933.9	No. 147/3	BH	3	36	I
9	44.4	424736.6	4742943.6	No. 31	BH	3	20	II
10	55.4	413860.4	4743849.2		School	3	60	III

4 Baseline Noise Levels

18. 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

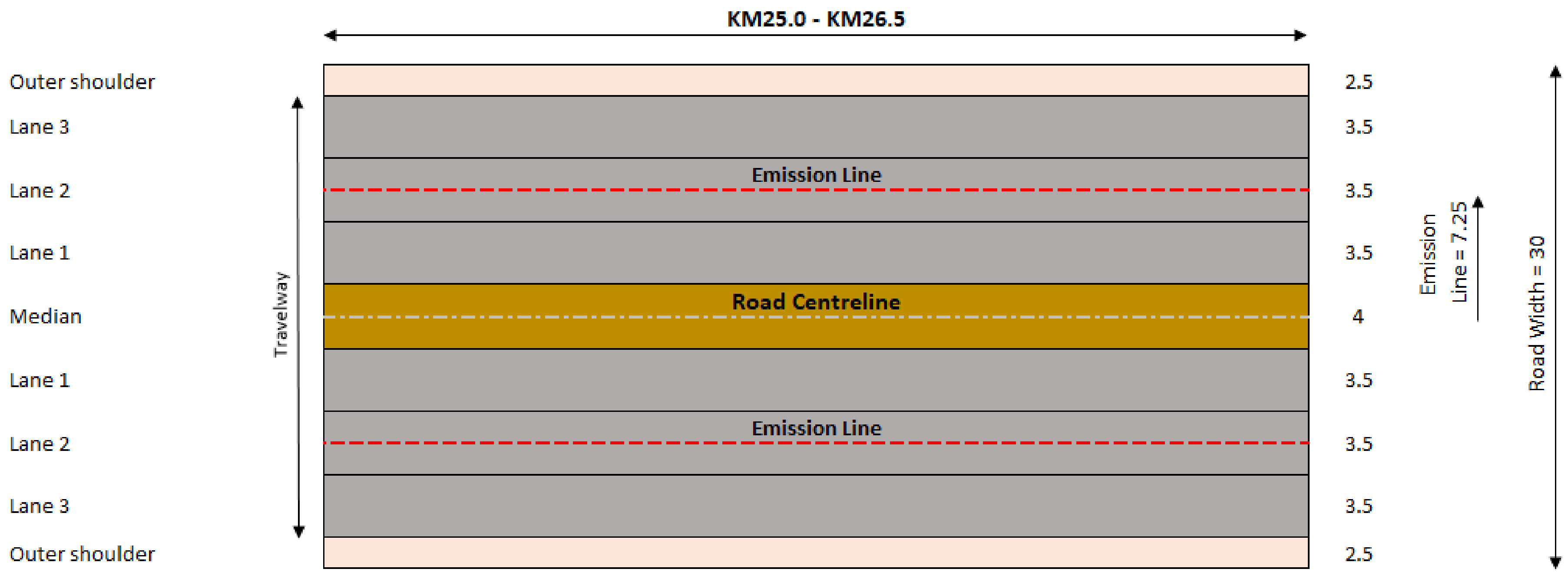
19. **Table 4.1** provides the list and description of the variable parameters of the model used for noise simulations.

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** to **Table 4.5** provide the calculation of traffic volume in each zone.
Vehicle speed	The Project road was divided into high and slow speed sections as provided by Client and as given below. • KM15.9 – KM19.0 (high speed section) 80 km per hour (km/h) for all modes of vehicle both during day and night • KM19.0 – KM61.0 (slow speed section) 60 km/h for all modes of vehicle both during day and night
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)	Emission Line (from road centerline) (m)
KM15.9-KM19.0	4	3.75	4.0	19.0	5.75
KM19.0-KM25.0	2	3.75	4.0	11.5	3.875
KM25.0-KM26.5	6	3.5	4.0	25.0	7.25
KM26.5-KM61.0	2	3.75	4.0	11.5	3.875



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 I (KM9.0 to KM35.0)

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, KM9	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

Table 4.4: Traffic Volume Calculation for Traffic Zone II (KM35.0 to KM53.0)

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	561	30	117	0	12	17	4	11	1	**753**
08 to 09 AM	745	33	150	0	13	11	6	26	0	**984**
09 to 10 AM	773	80	259	0	56	48	18	39	11	**1,273**
10 to 11 AM	996	95	245	2	47	26	17	34	7	**1,462**
11 to 12 AM	760	71	193	0	58	54	35	50	5	**1,221**
12 to 13 PM	928	71	132	2	24	17	6	20	1	**1,200**
13 to 14 PM	610	65	158	0	15	21	9	27	3	**905**
14 to 15 PM	815	92	174	0	40	24	21	39	6	**1,205**
15 to 16 PM	912	64	222	0	37	41	11	49	4	**1,336**
16 to 17 PM	899	88	179	0	37	35	15	36	3	**1,289**
17 to 18 PM	864	81	202	0	30	24	9	26	10	**1,236**
18 to 19 PM	1,055	100	186	0	43	39	11	38	7	**1,472**
19 to 20 PM	837	59	149	0	21	14	10	22	2	**1,112**
20 to 21 PM	767	32	168	1	14	8	8	19	3	**1,017**
21 to 22 PM	670	19	67	3	13	8	3	19	1	**802**
22 to 23 PM	400	12	42	3	7	5	9	25	2	**503**
23 to 00 PM	300	14	27	0	5	5	3	19	0	**373**
00 to 01AM	300	7	18	1	3	2	5	4	3	**340**
01 to 02 AM	210	4	8	0	3	2	1	4	1	**232**

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
02 to 03 AM	119	6	17	1	6	4	5	8	0	**166**
03 to 04 AM	82	5	10	1	3	2	3	0	0	**106**
04 to 05 AM	102	8	19	1	3	3	2	1	0	**139**
05 to 06 AM	165	7	28	2	6	3	2	5	0	**218**
06 to 07 AM	371	17	77	2	18	11	2	8	0	**506**

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

Location: Sadove, KM35	Cars	Trucks	Total
Day	Total: 15,773 Hourly: 1,052	Total: 1,557 Hourly: 104	**17,267**
Night	Total: 2,375 Hourly: 264	Total: 214 Hourly: 24	**2,583**

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

Table 4.5: Traffic Volume Calculation for Traffic Zone III (KM53.0 to KM61.0)

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	212	42	52	1	22	20	5	18	0	**372**
08 to 09 AM	360	32	58	0	21	26	19	15	2	**533**
09 to 10 AM	387	62	143	0	30	25	16	23	3	**689**
10 to 11 AM	437	15	22	0	15	12	6	20	0	**527**
11 to 12 AM	386	40	66	0	18	14	5	28	4	**561**
12 to 13 PM	316	22	53	1	13	8	5	22	3	**443**
13 to 14 PM	243	17	41	1	11	7	14	24	2	**360**
14 to 15 PM	362	52	113	0	26	15	25	10	1	**604**
15 to 16 PM	568	48	133	0	26	26	13	25	3	**842**
16 to 17 PM	412	71	145	1	40	34	18	41	4	**766**
17 to 18 PM	530	55	156	2	34	32	21	38	0	**868**
18 to 19 PM	305	61	92	2	54	57	24	48	5	**648**
19 to 20 PM	324	64	74	0	52	36	21	53	1	**625**
20 to 21 PM	276	91	99	1	36	27	12	28	4	**574**
21 to 22 PM	324	70	62	0	49	44	18	43	0	**610**
22 to 23 PM	186	57	30	3	30	22	18	14	1	**361**
23 to 00 PM	114	29	19	2	7	4	6	12	0	**193**
00 to 01AM	87	15	17	1	7	11	11	15	1	**165**
01 to 02 AM	58	14	15	1	6	9	8	19	0	**130**

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
02 to 03 AM	57	9	10	1	11	8	6	2	0	**104**
03 to 04 AM	54	10	10	0	7	15	7	9	0	**112**
04 to 05 AM	60	18	15	1	8	4	5	3	0	**114**
05 to 06 AM	95	26	16	0	11	13	10	15	0	**186**
06 to 07 AM	160	33	20	1	14	4	5	8	0	**245**

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

Location: *Poltavka*, KM53	Cars	Trucks	Total
Day	Total: 7,493 Hourly: 500	Total: 1,529 Hourly: 102	**9,022**
Night	Total: 1,234 Hourly: 137	Total: 376 Hourly: 42	**1,610**

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

20. The day and nighttime noise contours for the entire 45.1 km of road section modeled are included as **Annex I**.

21. Noise contours for representative section of outside and inside population centers taken from the file provided by the Client[11] are discussed in this section.

4.2.1 Outside Population Centers (KM15.9 – KM19.0)

22. 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 contours for section KM15.9 – KM16.3. 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 – 55 dBA.

4.2.2 Inside Population Centers (KM19.0 – KM61.0)

23. Areas inside population centers are classified as high and low congested areas.

4.2.2.1 High Congestion Areas

24. 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 4.3** shows an example nighttime noise contours for section KM35.4 – KM35.8. It can be observed that the contours lines are affected by each structure coming in the path and the 50 dBA to 55 dBA area comes closer to the road centerline (approximately at 30 m from the road centerline) which will be beneficial for the structures behind first row.

4.2.2.2 Low Congestion Areas

25. These are the areas where there are scattered structures and are non-uniformly distributed on both sides of the road. **Figure 4.4** shows an example nighttime noise contours for section KM33.9 – KM34.3. The contours lines are affected by each structure coming in the path but are somewhat streamlined and similar to those for outside population center. Also, the 50 dBA to 55 dBA area comes closer to the road centerline (approximately at 30 m from the road centerline) where there are structures, beyond which the distance again increases and the 50 dBA to 55 dBA contour is located at a distance of approximately 70 m from the road centerline.

[11] Explanatory note FINAL EN –Table 3.1.3. Existing and projected width of road section Bishkek – Kara-Balta at Page No. 23.

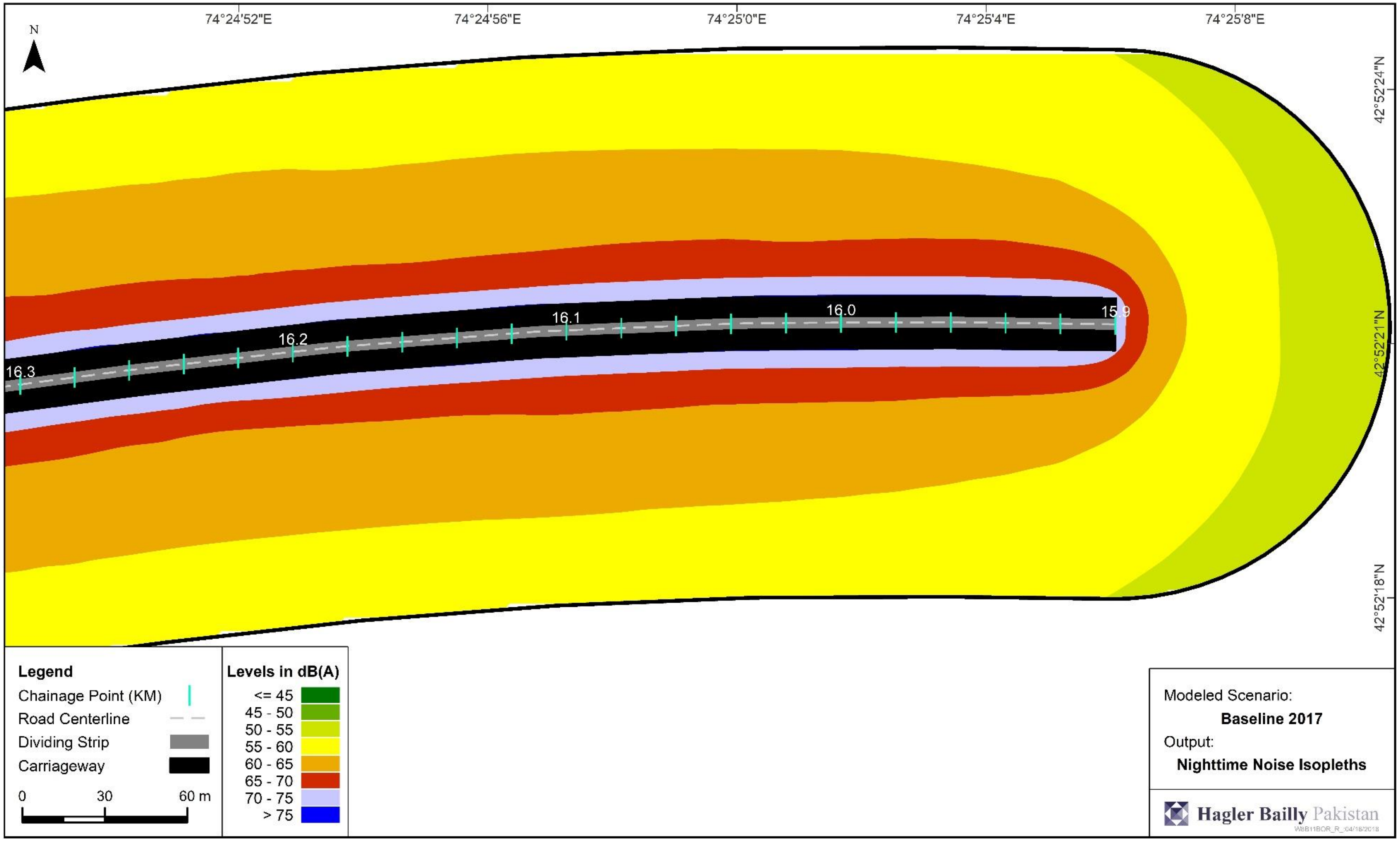


Figure 4.2: Outside Population Centers - Nighttime Noise Isopleths

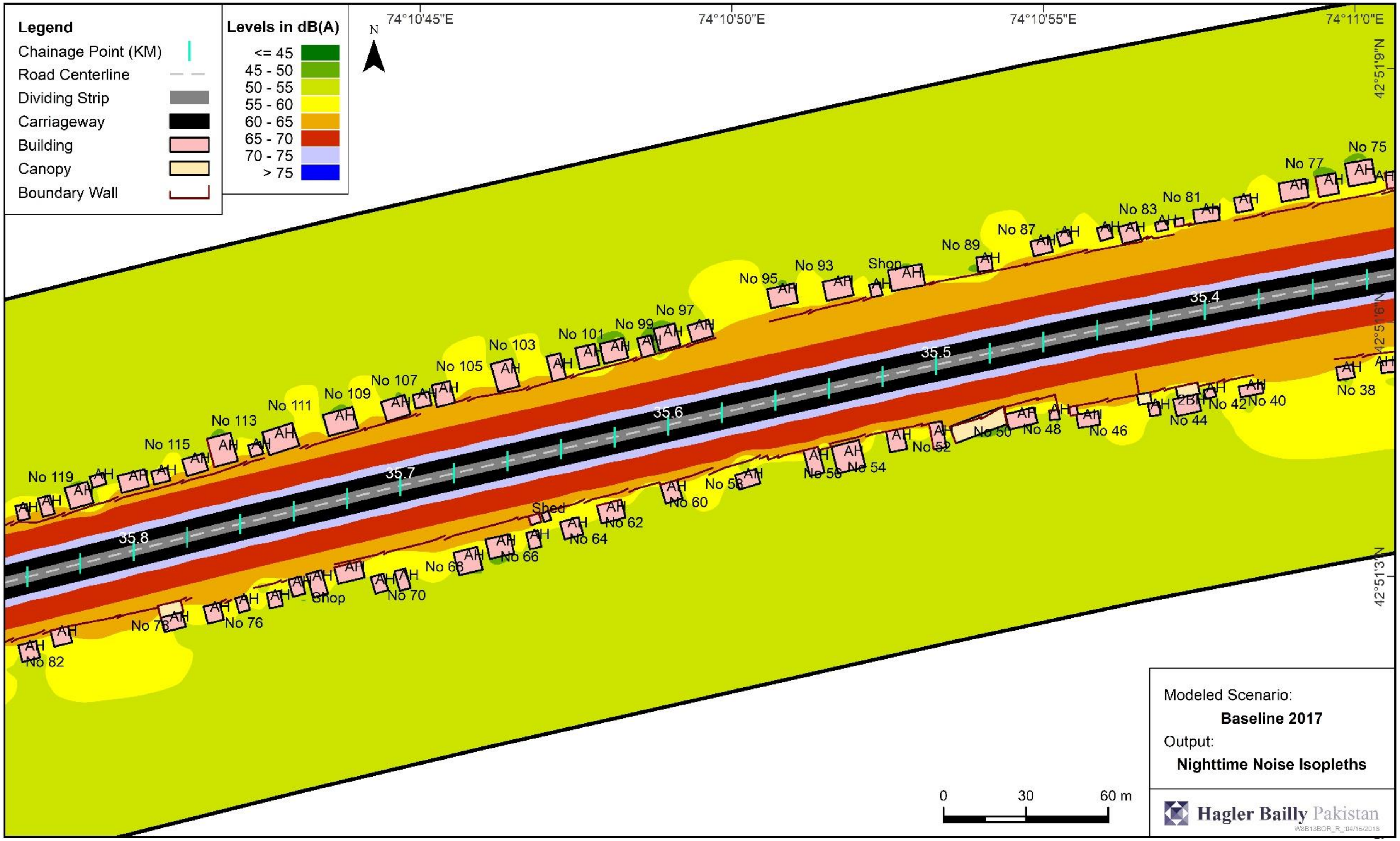


Figure 4.3: High Congestion Areas - Nighttime Noise Isopleths

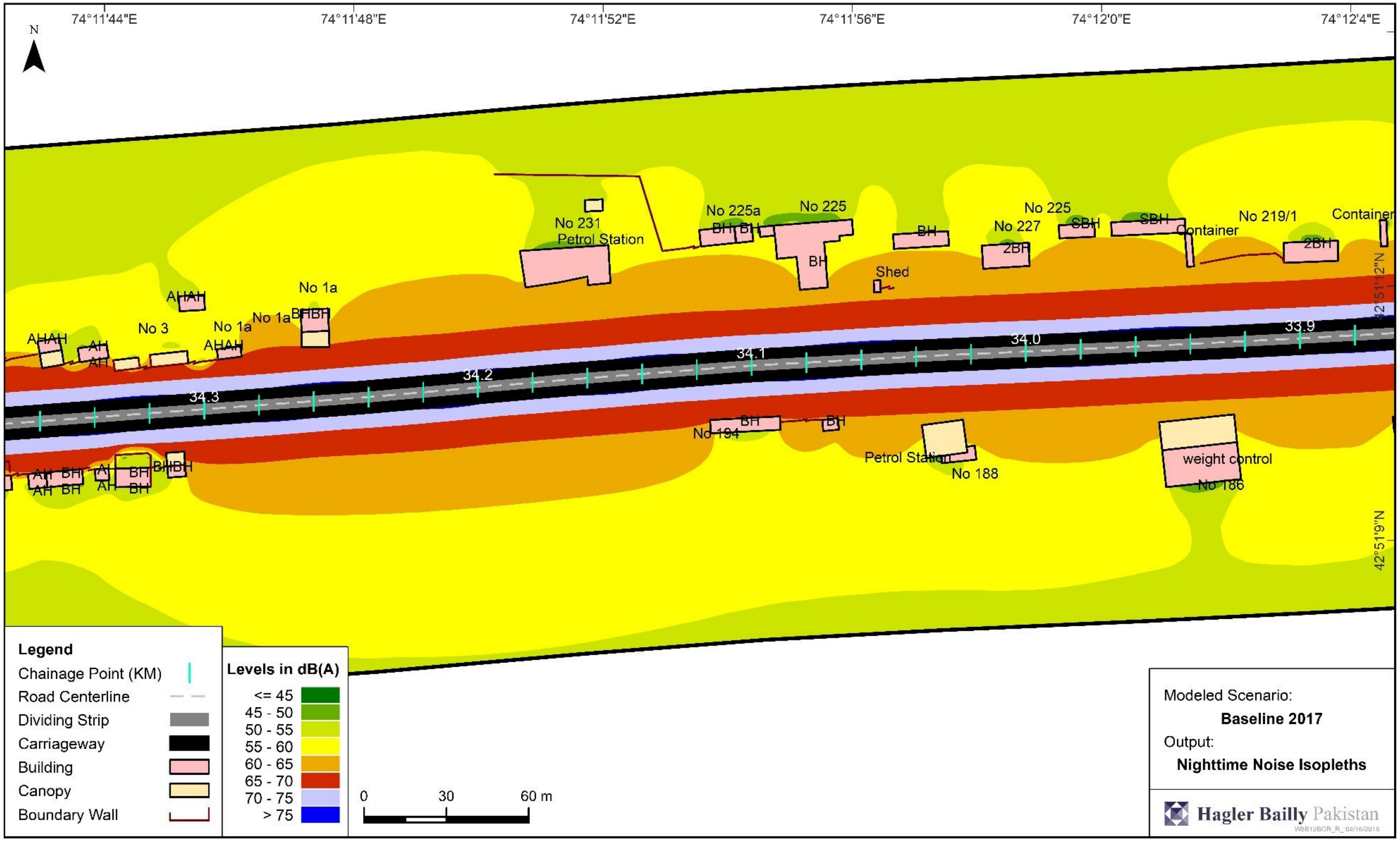


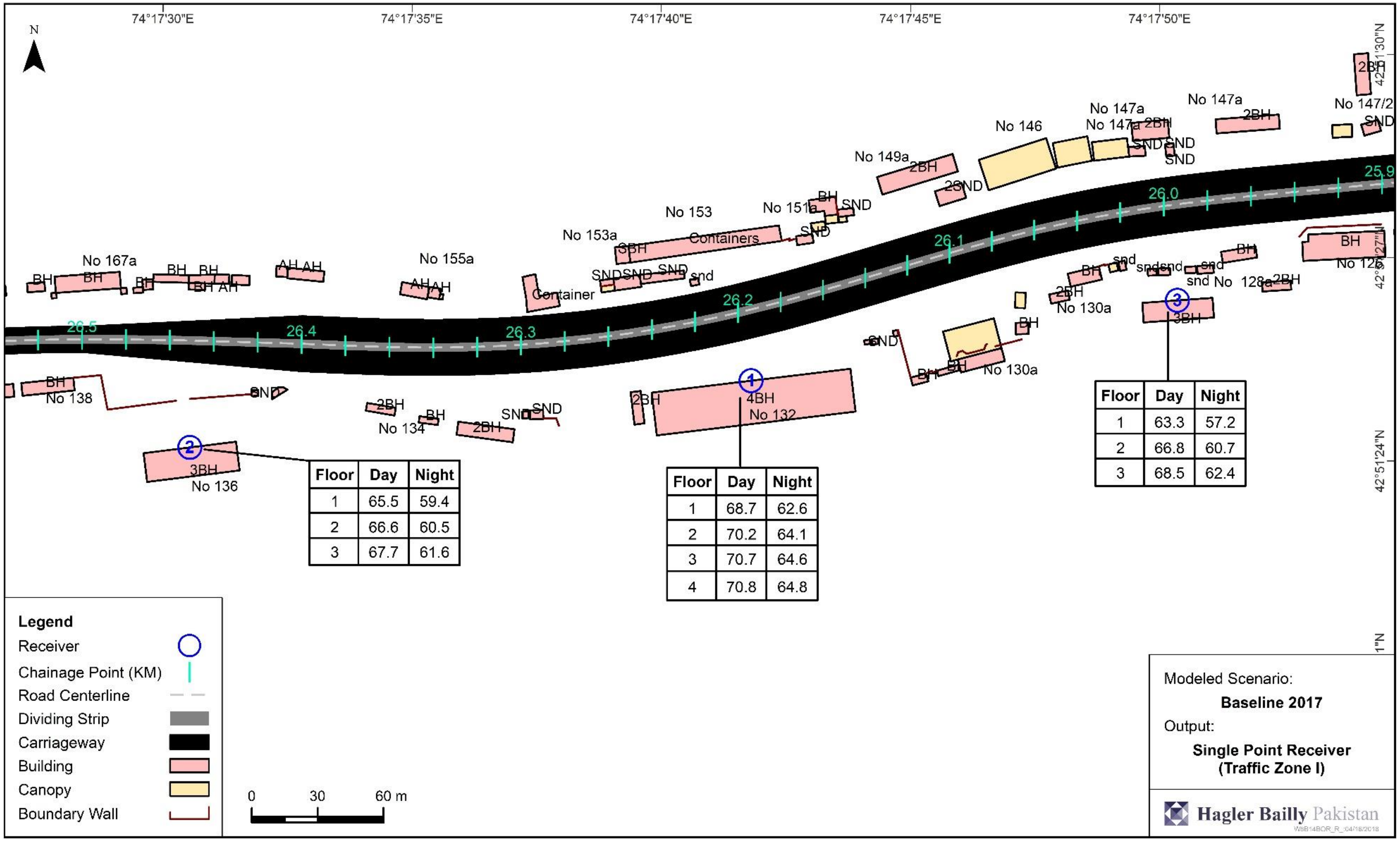
Figure 4.4: Low Congestion Areas - Nighttime Noise Isopleths

4.3 Single Point Receivers

26. **Table 4.6** 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 daytime and nighttime noise levels exceed the 55 dBA and 45 dBA limit by 13 dBA and 17 dBA, respectively.

Table 4.6: Receiver Baseline Noise Levels

Receiver No.	Building Side	Floor	Day	Night	Exceedance from 55 dBA (Day)	Exceedance from 45 dBA (Night)
1	North	1	68.7	62.6	13.7	17.6
		2	70.2	64.1	15.2	19.1
		3	70.7	64.6	15.7	19.6
		4	70.8	64.8	15.8	19.8
2	North	1	65.5	59.4	10.5	14.4
		2	66.6	60.5	11.6	15.5
		3	67.7	61.6	12.7	16.6
3	North	1	63.3	57.2	8.3	12.2
		2	66.8	60.7	11.8	15.7
		3	68.5	62.4	13.5	17.4
4	South	1	67.4	61.3	12.4	16.3
		2	68.9	62.8	13.9	17.8
		3	69.6	63.5	14.6	18.5
5	North	1	63.9	57.8	8.9	12.8
		2	64.6	58.5	9.6	13.5
		3	65.3	59.2	10.3	14.2
6	North	1	72.4	66.3	17.4	21.3
		2	73.0	66.9	18.0	21.9
		3	72.9	66.9	17.9	21.9
7	North	1	62.3	56.2	7.3	11.2
		2	63.9	57.9	8.9	12.9
		3	64.7	58.6	9.7	13.6
8	South	1	67.4	61.3	12.4	16.3
		2	69.0	62.9	14.0	17.9
		3	70.0	63.9	15.0	18.9
9	South	1	69.8	63.5	14.8	18.5
		2	71.1	64.9	16.1	19.9
		3	71.2	65.0	16.2	20.0
10	North	1	62.1	58.0	7.1	13.0
		2	62.9	58.7	7.9	13.7
		3	63.6	59.5	8.6	14.5



Receiver 1 (4BH, No 132)

Floor	Day	Night
1	68.7	62.6
2	70.2	64.1
3	70.7	64.6
4	70.8	64.8

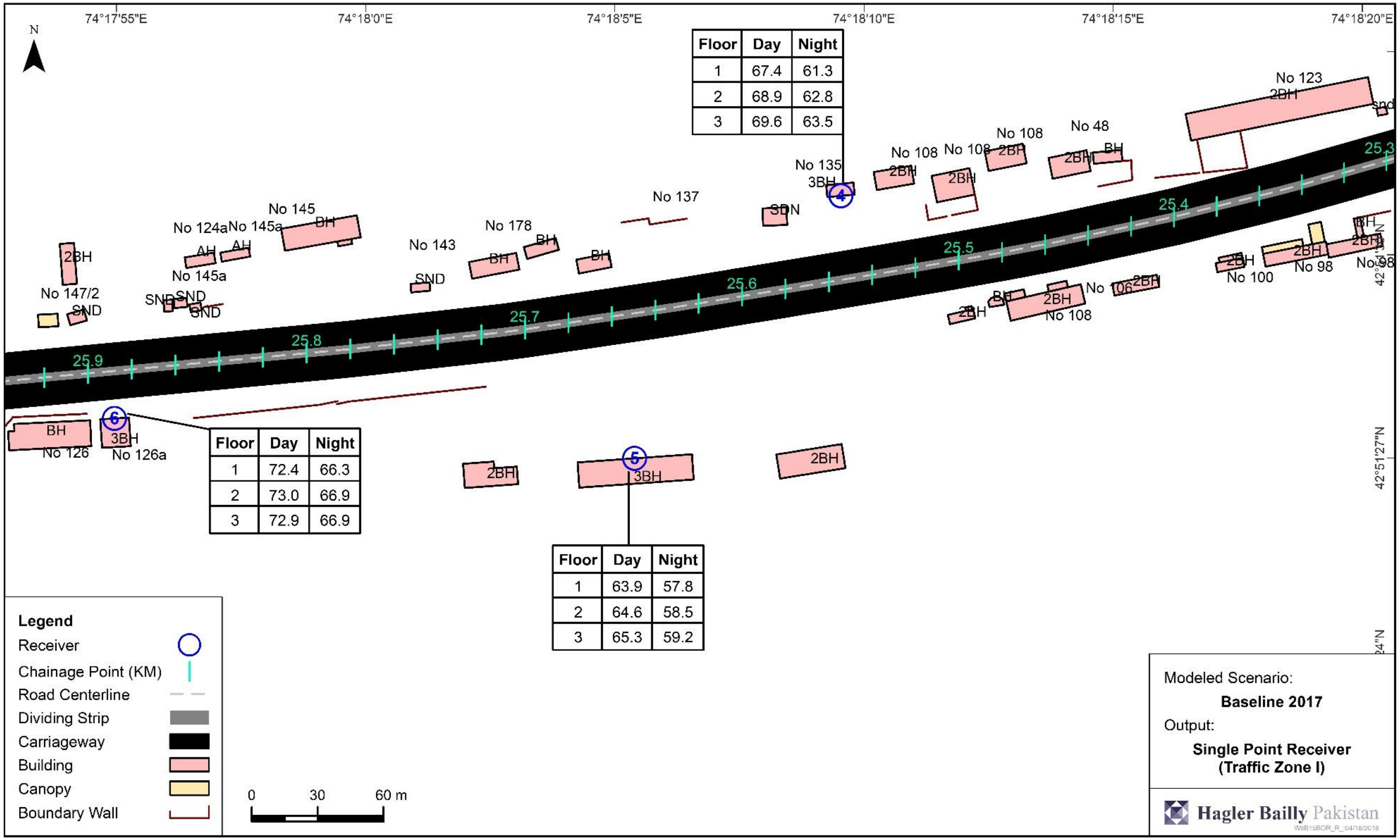
Receiver 2 (3BH, No 136)

Floor	Day	Night
1	65.5	59.4
2	66.6	60.5
3	67.7	61.6

Receiver 3 (3BH)

Floor	Day	Night
1	63.3	57.2
2	66.8	60.7
3	68.5	62.4

Figure 4.5: Baseline 2017 – Single Point Receiver (Traffic Zone I – Receiver 1, 2, 3)



Receiver 4:

Floor	Day	Night
1	67.4	61.3
2	68.9	62.8
3	69.6	63.5

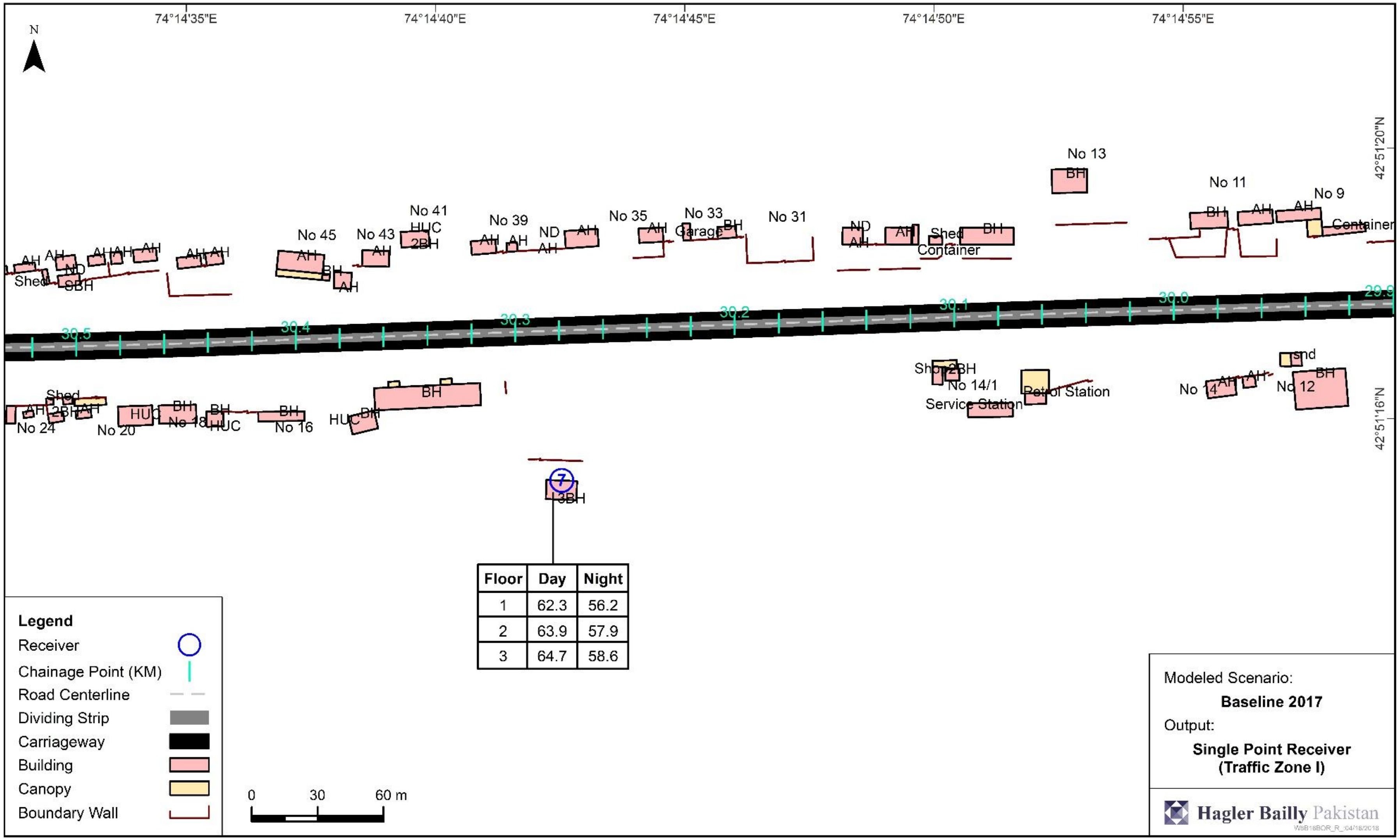
Receiver 6:

Floor	Day	Night
1	72.4	66.3
2	73.0	66.9
3	72.9	66.9

Receiver 5:

Floor	Day	Night
1	63.9	57.8
2	64.6	58.5
3	65.3	59.2

Figure 4.6: Baseline 2017 – Single Point Receiver (Traffic Zone I – Receiver 4, 5, 6)



Floor	Day	Night
1	62.3	56.2
2	63.9	57.9
3	64.7	58.6

Figure 4.7: Baseline 2017 – Single Point Receiver (Traffic Zone I – Receiver 7)

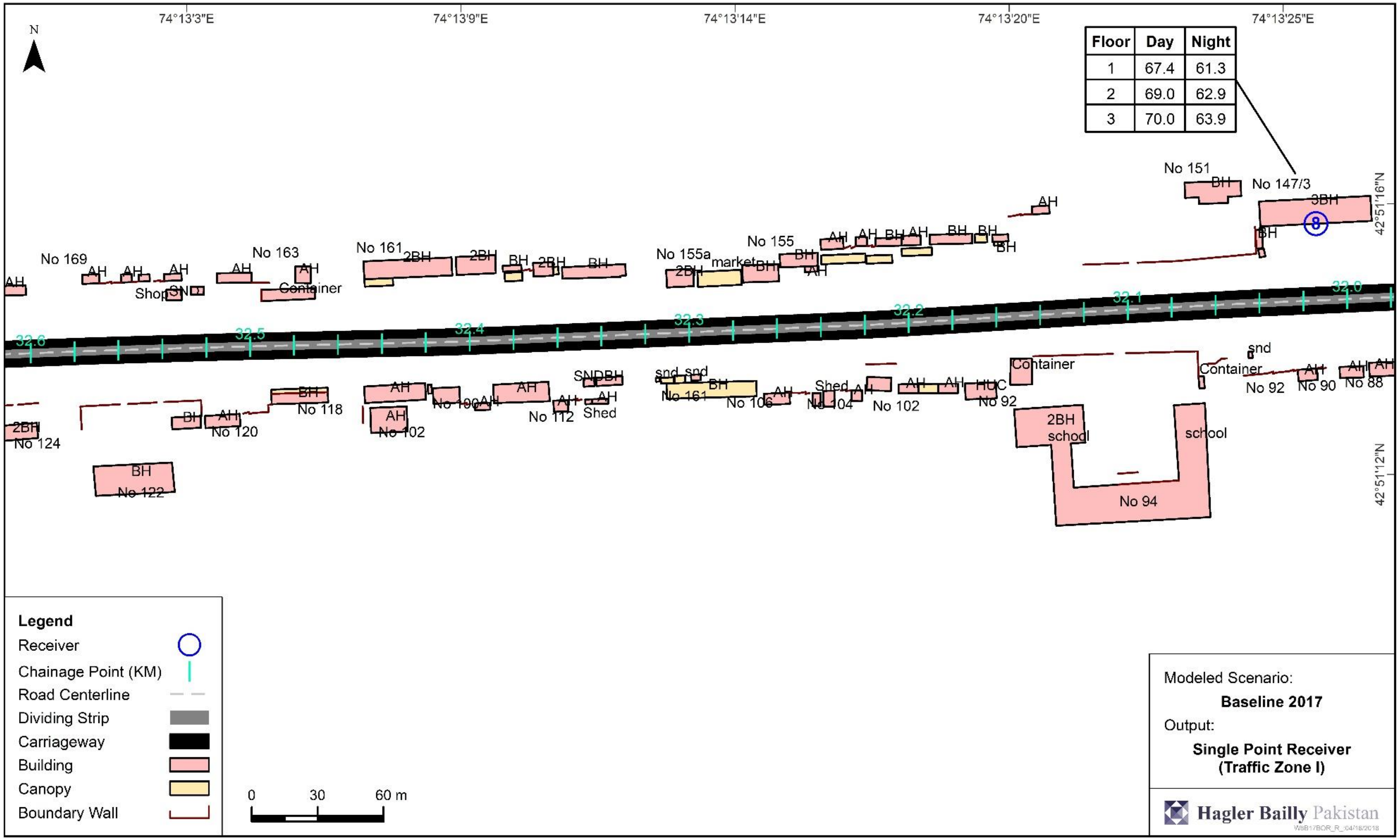


Figure 4.8: Baseline 2017 – Single Point Receiver (Traffic Zone I – Receiver 8)

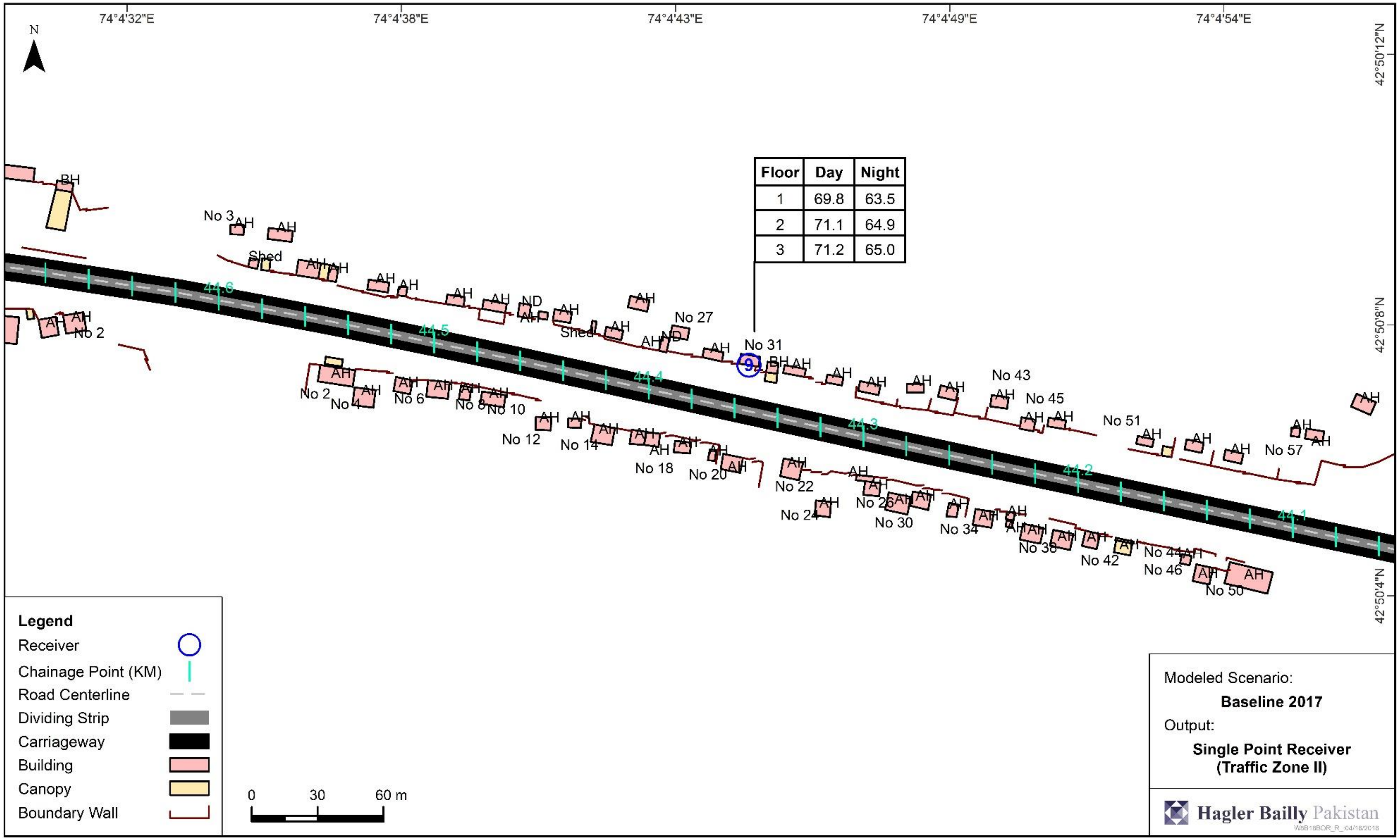
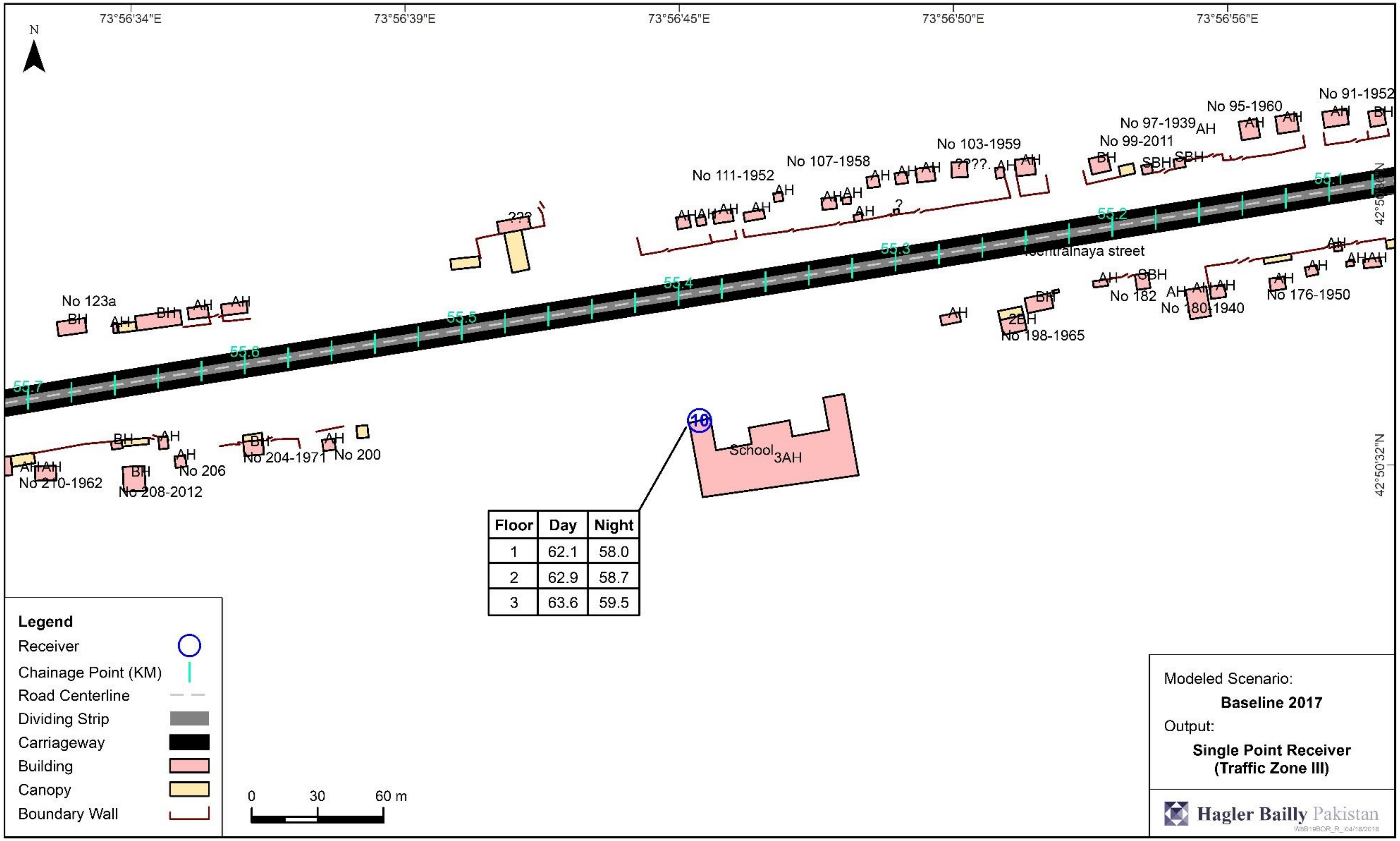


Figure 4.9: Baseline 2017 – Single Point Receiver (Traffic Zone II – Receiver 9)



Floor	Day	Night
1	62.1	58.0
2	62.9	58.7
3	63.6	59.5

Figure 4.10: Baseline 2017 – Single Point Receiver (Traffic Zone III – Receiver 10)

4.4 Conclusions

27. 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 13 dBA and 17 dBA, respectively. For compliance purposes, it would be appropriate to use IFC guideline of baseline + 3 dBA.

5 Construction Noise Levels

28. 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 are 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.

29. 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

30. The equipment noise level has been taken from a comprehensive inventory of construction equipment noise measurements developed by the FHWA of the United States.[12] 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.

31. 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.

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[12] 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

32. 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

33. 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.

34. 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

35. 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 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.</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.[13] Hourly traffic volume for the three sections used in the modeling is given below.
Traffic Zone I (most traffic): 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>
Traffic Zone II (moderate traffic): Sadove (KM35.0) – Poltavka (KM53.0)
<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>1,118</td><td>281</td></tr>
<tr><td>Trucks</td><td>108</td><td>25</td></tr>
<tr><td rowspan="2">2019</td><td>Cars</td><td>1,190</td><td>299</td></tr>
<tr><td>Trucks</td><td>112</td><td>26</td></tr>
<tr><td rowspan="2">2020</td><td>Cars</td><td>1,265</td><td>318</td></tr>
<tr><td>Trucks</td><td>117</td><td>27</td></tr>
</table>
Traffic Zone III (least traffic): Poltavka (KM53.0) – Kara Balta (KM61.0)
<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>530</td><td>146</td></tr>
<tr><td>Trucks</td><td>106</td><td>43</td></tr>
<tr><td rowspan="2">2019</td><td>Cars</td><td>563</td><td>155</td></tr>
<tr><td>Trucks</td><td>110</td><td>45</td></tr>
<tr><td rowspan="2">2020</td><td>Cars</td><td>598</td><td>164</td></tr>
<tr><td>Trucks</td><td>115</td><td>47</td></tr>
</table></td></tr>
<tr><td>Vehicle speed</td><td>The Project road was divided into high and slow speed sections as provided</td></tr>
</table>

[13] 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.

Parameter	Description
	by Client and as given below. • KM15.9 – KM19.0 (high speed section) 80 km per hour (km/h) for all modes of vehicle both during day and night • KM19.0 – KM61.0 (slow speed section) 60 km/h for all modes of vehicle both during day and night
Pavement	Asphalt concrete with considerable roughness that adds 2 dBA to the noise levels due to poor condition of the road.
Construction equipment	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.[14] 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.

Table 5.5: Road Widths

Road Section	No. of Lanes	Each Lane Width (m)	Dividing Strip (m)	Road Width (m)	Emission Line (from road centerline) (m)
KM15.9-KM19.0	4	3.75	4.0	19.0	5.75
KM19.0-KM25.0	2	3.75	4.0	11.5	3.875
KM25.0-KM26.5	6	3.5	4.0	25.0	7.25
KM26.5-KM61.0	2	3.75	4.0	11.5	3.875

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

14 https://www.nrc.gov/docs/ML1225/ML12250A723.pdf

5.3 Predicted Construction Noise Levels

5.3.1 No Construction Activity

36. 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.

37. 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.

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
1	1	68.7	62.6	68.9	62.9	0.2	0.3	69.2	63.1	0.5	0.5	69.4	63.4	0.7	0.8
	2	70.2	64.1	70.4	64.4	0.2	0.3	70.6	64.6	0.4	0.5	70.9	64.9	0.7	0.8
	3	70.7	64.6	71.0	64.9	0.3	0.3	71.2	65.2	0.5	0.6	71.4	65.4	0.7	0.8
	4	70.8	64.8	71.1	65.0	0.3	0.2	71.3	65.3	0.5	0.5	71.5	65.5	0.7	0.7
2	1	65.5	59.4	65.7	59.6	0.2	0.2	65.9	59.9	0.4	0.5	66.2	60.2	0.7	0.8
	2	66.6	60.5	66.9	60.8	0.3	0.3	67.1	61.1	0.5	0.6	67.3	61.3	0.7	0.8
	3	67.7	61.6	67.9	61.9	0.2	0.3	68.1	62.1	0.4	0.5	68.4	62.4	0.7	0.8
3	1	63.3	57.2	63.5	57.4	0.2	0.2	63.7	57.7	0.4	0.5	64.0	58.0	0.7	0.8
	2	66.8	60.7	67.0	61.0	0.2	0.3	67.3	61.2	0.5	0.5	67.5	61.5	0.7	0.8
	3	68.5	62.4	68.8	62.7	0.3	0.3	69.0	63.0	0.5	0.6	69.2	63.2	0.7	0.8
4	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	68.9	62.8	69.2	63.1	0.3	0.3	69.4	63.3	0.5	0.5	69.6	63.6	0.7	0.8
	3	69.6	63.5	69.8	63.8	0.2	0.3	70.1	64.0	0.5	0.5	70.3	64.3	0.7	0.8
5	1	63.9	57.8	64.1	58.1	0.2	0.3	64.4	58.3	0.5	0.5	64.6	58.6	0.7	0.8
	2	64.6	58.5	64.8	58.8	0.2	0.3	65.1	59.0	0.5	0.5	65.3	59.3	0.7	0.8
	3	65.3	59.2	65.5	59.4	0.2	0.2	65.7	59.7	0.4	0.5	65.9	60.0	0.6	0.8
6	1	72.4	66.3	72.6	66.5	0.2	0.2	72.8	66.8	0.4	0.5	73.1	67.1	0.7	0.8
	2	73.0	66.9	73.2	67.1	0.2	0.2	73.4	67.4	0.4	0.5	73.6	67.7	0.6	0.8
	3	72.9	66.9	73.2	67.1	0.3	0.2	73.4	67.4	0.5	0.5	73.6	67.6	0.7	0.7
7	1	62.3	56.2	62.5	56.5	0.2	0.3	62.8	56.7	0.5	0.5	63.0	57.0	0.7	0.8
	2	63.9	57.9	64.2	58.1	0.3	0.2	64.4	58.4	0.5	0.5	64.6	58.6	0.7	0.7
	3	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
8	1	67.4	61.3	67.6	61.6	0.2	0.3	67.9	61.8	0.5	0.5	68.1	62.1	0.7	0.8
	2	69.0	62.9	69.2	63.2	0.2	0.3	69.4	63.4	0.4	0.5	69.7	63.7	0.7	0.8
	3	70.0	63.9	70.2	64.1	0.2	0.2	70.4	64.4	0.4	0.5	70.7	64.7	0.7	0.8

No	F	2017		2018		IOB		2019		IOB		2020		IOB	
		D	N	D	N	D	N	D	N	D	N	D	N	D	N
9	1	69.8	63.5	70.0	63.7	0.2	0.2	70.1	63.9	0.3	0.4	70.4	64.1	0.6	0.6
	2	71.1	64.9	71.3	65.1	0.2	0.2	71.4	65.3	0.3	0.4	71.7	65.5	0.6	0.6
	3	71.2	65.0	71.4	65.2	0.2	0.2	71.5	65.4	0.3	0.4	71.8	65.6	0.6	0.6
10	1	62.1	58.0	62.3	58.1	0.2	0.1	62.5	58.3	0.4	0.3	62.7	58.5	0.6	0.5
	2	62.9	58.7	63.1	58.9	0.2	0.2	63.2	59.1	0.3	0.4	63.4	59.3	0.5	0.6
	3	63.6	59.5	63.8	59.6	0.2	0.1	64.0	59.8	0.4	0.3	64.2	60.0	0.6	0.5

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

5.3.2 With Construction Activity

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 stages C and D by an average of 1 dBA, respectively during the construction period. The nighttime noise levels exceed in all stages. During nighttime the levels exceed by an average of 1.5 dBA, 3.3 dBA, 5.2 dBA and 1.7 dBA in stages A, B, C and D, respectively.

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	1.8	4.4	2.2	5.2	3.9	8.1	1.9	4.6
2019	1.9	4.5	2.3	5.3	4.0	8.2	2.1	4.7
2020	2.1	4.6	2.5	5.4	4.1	8.2	4.3	4.9

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 0.5 dBA, 1.2 dBA, 3.8 dBA and 0.9 dBA in stages A, B, C and D, respectively. During nighttime the levels exceed by an average of 4.3 dBA, 5.5 dBA, 8.7 dBA and 5.0 dBA in stages A, B, C and D, respectively.

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	7.2	4.1	8.5	6.7	11.6	3.8	7.9
2019	3.5	7.3	4.2	8.5	6.8	11.7	3.9	8.0
2020	3.6	7.4	4.3	8.5	6.8	11.7	4.0	8.0

5.4 Suggested Mitigation Measures

38. 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.[15] 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.
  - 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,[16] careless or improper operation or inappropriate use of equipment can increase noise levels.

[15] US Federal Highway Authority. *Construction Noise Handbook*.

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.

- **Temporary Noise Barriers**. Until the permanent noise barriers are installed, temporary noise barriers can be installed between the apartments and the construction zone. Examples of noise barriers are shown in **Figure 5.1**.
- **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.

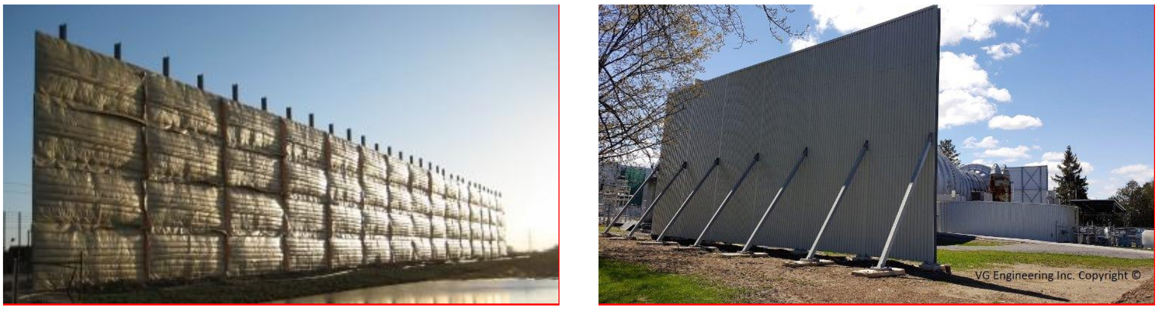


Figure 5.1: Examples of Temporary Noise Barriers

5.5 Conclusions

39. 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 3.8 dBA, respectively during daytime and 5.2 dBA and 8.7 dBA, respectively, during nighttime.

40. In summary, the increment over baseline during the active construction period with the maximum number of construction equipment deployed at the same time could

[16] 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.

be as much as 7 dBA over baseline during day (occurring 10% of the time) for certain period of the day. However, for the Typical Configuration, likely occurring about 90% of the time, the increase in noise is around 3.8 dBA. The impact of this increase depends on the total duration of the activity and the receptors.

41. The construction period (time that work is taking place) in any 400 m section modeled is not known. However, an estimate was made using the following assumptions:

- Total length of road: 45.1 km
- Total construction period: April-October 2017-2020; be up to 42 month
- Number of teams: 4 (assumed)
- Progress per team per month: 0.268 km (45.1/42/4)
- Time required for all work on 400 m: 45 days.

42. Therefore 45 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 3.8 dBA is predicted during daytime and during construction period.

6 Operational Noise Levels

43. 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

44. 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

Parameter	Description
Road width and emission line	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.
Traffic volume	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.[17] This is considered as the full traffic that will be on the new road during the operating years. However, the Client suggested that about 80% of the traffic in these years will be due to natural growth (projected traffic), whereas the remaining will be due to improved road surface and highway condition that will be simply due to road users who were previously not travelling due to the poor road condition (suppressed traffic). Therefore, apart from the full increase, a scenario in which the traffic is reduced by 20% is also considered. Hourly traffic volume for the three sections used in the modeling for full traffic (projected and suppressed) and reduced traffic (projected) is given below. • Bishkek (KM9.0) – Sadove (KM35.0)

17 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.

Year	Vehicle Type	Full Traffic		Reduced Traffic	
		Day	Night	Day	Night
2025	Cars	4,436	1,377	3,549	1,102
	Trucks	140	24	112	19
2030	Cars	6,103	1,894	4,882	1,515
	Trucks	171	29	137	23
2035	Cars	8,414	2,611	6,731	2,089
	Trucks	207	35	166	28

- Sadove (KM35.0) – Poltavka (KM53.0)

Year	Vehicle Type	Full Traffic		Reduced Traffic	
		Day	Night	Day	Night
2025	Cars	1,728	434	1,382	347
	Trucks	142	33	114	26
2030	Cars	2,365	594	1,892	475
	Trucks	173	40	138	32
2035	Cars	3,248	815	2,598	652
	Trucks	210	48	168	38

- Poltavka (KM53.0) – Kara Balta (KM61.0)

Year	Vehicle Type	Full Traffic		Reduced Traffic	
		Day	Night	Day	Night
2025	Cars	810	222	648	178
	Trucks	139	57	111	46
2030	Cars	1,101	302	881	242
	Trucks	170	70	136	56
2035	Cars	1,501	412	1,201	330
	Trucks	206	85	165	68

Parameter	Description
Vehicle speed	The Project road was divided into high and slow speed sections as provided by Client as given below. • KM15.9 – KM19.0 (high speed section) 80 km per hour (km/h) for all modes of vehicle both during day and night • KM19.0 – KM61.0 (slow speed section) 60 km/h for all modes of vehicle both during day and night
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)	Emission Line (from road centerline) (m)
KM15.9-KM19.0	4	3.75	4.0	19.0	5.75
KM19.0-KM25.0	4	3.5	4.0	18.0	5.5
KM25.0-KM26.5	6	3.5	4.0	25.0	7.25
KM26.5-KM61.0	4	3.5	4.0	18.0	5.5

6.2 Predicted Operational Noise Levels

45. Table 6.3, Table 6.4 and Table 6.5 Provides the unmitigated operational noise levels in 2025, 2030 and 2035 at selected receivers. The operational noise levels at selected receivers in year 5, 10 and 15 are in compliance with the IFC guideline of baseline + 3 dBA.

Table 6.3: Predicted Operational Noise Levels in 2025 – Unmitigated

Receiver No.	F	2017		2025			
		Day	Night	Day	Night	Daytime Increment	Nighttime Increment
1	1	68.7	62.6	68.5	62.6	-0.2	0.0
	2	70.2	64.1	70.0	64.1	-0.2	0.0
	3	70.7	64.6	70.6	64.6	-0.1	0.0
	4	70.8	64.8	70.7	64.8	-0.1	0.0
2	1	65.5	59.4	65.3	59.4	-0.2	0.0
	2	66.6	60.5	66.4	60.5	-0.2	0.0
	3	67.7	61.6	67.5	61.6	-0.2	0.0
3	1	63.3	57.2	63.1	57.2	-0.2	0.0
	2	66.8	60.7	66.6	60.7	-0.2	0.0
	3	68.5	62.4	68.4	62.4	-0.1	0.0
4	1	67.4	61.3	67.3	61.3	-0.1	0.0
	2	68.9	62.8	68.8	62.8	-0.1	0.0
	3	69.6	63.5	69.4	63.5	-0.2	0.0
5	1	63.9	57.8	63.8	57.8	-0.1	0.0
	2	64.6	58.5	64.4	58.5	-0.2	0.0
	3	65.3	59.2	65.1	59.2	-0.2	0.0
6	1	72.4	66.3	72.2	66.3	-0.2	0.0
	2	73.0	66.9	72.8	66.9	-0.2	0.0
	3	72.9	66.9	72.8	66.9	-0.1	0.0

Receiver No.	F	2017		2025			
		Day	Night	Day	Night	Daytime Increment	Nighttime Increment
7	1	62.3	56.2	62.1	56.2	-0.2	0.0
	2	63.9	57.9	63.8	57.9	-0.1	0.0
	3	64.7	58.6	64.6	58.6	-0.1	0.0
8	1	67.4	61.3	67.3	61.4	-0.1	0.1
	2	69.0	62.9	69.0	63.1	0.0	0.2
	3	70.0	63.9	69.9	63.9	-0.1	0.0
9	1	69.8	63.5	69.7	63.5	-0.1	0.0
	2	71.1	64.9	70.9	64.7	-0.2	-0.2
	3	71.2	65.0	71.0	64.8	-0.2	-0.2
10	1	62.1	58.0	61.7	57.5	-0.4	-0.5
	2	62.9	58.7	62.4	58.2	-0.5	-0.5
	3	63.6	59.5	63.2	59.0	-0.4	-0.5

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
1	1	68.7	62.6	69.7	63.8	1.0	1.2
	2	70.2	64.1	71.2	65.3	1.0	1.2
	3	70.7	64.6	71.7	65.9	1.0	1.3
	4	70.8	64.8	71.9	66.0	1.1	1.2
2	1	65.5	59.4	66.5	60.6	1.0	1.2
	2	66.6	60.5	67.6	61.7	1.0	1.2
	3	67.7	61.6	68.7	62.8	1.0	1.2
3	1	63.3	57.2	64.3	58.4	1.0	1.2
	2	66.8	60.7	67.8	61.9	1.0	1.2
	3	68.5	62.4	69.5	63.7	1.0	1.3
4	1	67.4	61.3	68.4	62.6	1.0	1.3
	2	68.9	62.8	69.9	64.1	1.0	1.3
	3	69.6	63.5	70.6	64.7	1.0	1.2
5	1	63.9	57.8	64.9	59.1	1.0	1.3
	2	64.6	58.5	65.6	59.7	1.0	1.2
	3	65.3	59.2	66.3	60.4	1.0	1.2

Receiver No.	F	2017		2030			
		Day	Night	Day	Night	Daytime Increment	Nighttime Increment
6	1	72.4	66.3	73.4	67.5	1.0	1.2
	2	73.0	66.9	74.0	68.1	1.0	1.2
	3	72.9	66.9	74.0	68.1	1.1	1.2
7	1	62.3	56.2	63.3	57.4	1.0	1.2
	2	63.9	57.9	65.0	59.1	1.1	1.2
	3	64.7	58.6	65.8	59.9	1.1	1.3
8	1	67.4	61.3	68.5	62.6	1.1	1.3
	2	69.0	62.9	70.2	64.3	1.2	1.4
	3	70.0	63.9	71.0	65.2	1.0	1.3
9	1	69.8	63.5	70.8	64.6	1.0	1.1
	2	71.1	64.9	72.0	65.8	0.9	0.9
	3	71.2	65.0	72.0	65.8	0.8	0.8
10	1	62.1	58.0	62.7	58.4	0.6	0.4
	2	62.9	58.7	63.4	59.2	0.5	0.5
	3	63.6	59.5	64.1	59.9	0.5	0.4

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
1	1	68.7	62.6	70.9	65.1	2.2	2.5
	2	70.2	64.1	72.4	66.6	2.2	2.5
	3	70.7	64.6	72.9	67.1	2.2	2.5
	4	70.8	64.8	73.1	67.3	2.3	2.5
2	1	65.5	59.4	67.7	61.9	2.2	2.5
	2	66.6	60.5	68.8	63.0	2.2	2.5
	3	67.7	61.6	69.9	64.1	2.2	2.5
3	1	63.3	57.2	65.5	59.7	2.2	2.5
	2	66.8	60.7	69.0	63.2	2.2	2.5
	3	68.5	62.4	70.7	64.9	2.2	2.5
4	1	67.4	61.3	69.6	63.8	2.2	2.5
	2	68.9	62.8	71.1	65.3	2.2	2.5
	3	69.6	63.5	71.8	66.0	2.2	2.5

Receiver No.	F	2017		2035			
		Day	Night	Day	Night	Daytime Increment	Nighttime Increment
5	1	63.9	57.8	66.1	60.3	2.2	2.5
	2	64.6	58.5	66.8	61.0	2.2	2.5
	3	65.3	59.2	67.5	61.7	2.2	2.5
6	1	72.4	66.3	74.6	68.8	2.2	2.5
	2	73.0	66.9	75.2	69.4	2.2	2.5
	3	72.9	66.9	75.2	69.4	2.3	2.5
7	1	62.3	56.2	64.5	58.7	2.2	2.5
	2	63.9	57.9	66.2	60.4	2.3	2.5
	3	64.7	58.6	67.0	61.1	2.3	2.5
8	1	67.4	61.3	69.7	63.9	2.3	2.6
	2	69.0	62.9	71.4	65.6	2.4	2.7
	3	70.0	63.9	72.2	66.4	2.2	2.5
9	1	69.8	63.5	71.8	65.6	2.0	2.1
	2	71.1	64.9	73.0	66.8	1.9	1.9
	3	71.2	65.0	73.1	66.9	1.9	1.9
10	1	62.1	58.0	63.6	59.4	1.5	1.4
	2	62.9	58.7	64.4	60.1	1.5	1.4
	3	63.6	59.5	65.1	60.9	1.5	1.4

Note: F = Floor

6.3 Noise Contours

46. The predicted unmitigated day and nighttime noise contours of the year 15 (2035) for the entire of 45.1 km are included as **Annex III**.

6.4 Compliance with IFC Guidelines

47. 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 compliance status contours for both day and nighttime are included as **Annex IV**.

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)

48. **Table 6.6** provides the compliance status of structures along the 45.1 km road. There are total of 4 and 135 structure that are non-compliant during day and night, respectively.

49. **Table 6.7** and **Table 6.8** provides the details of non-compliant structures along with the baseline and operation's unmitigated noise levels during day and nighttime, receptively.

Table 6.6: Compliance Status before Mitigation

Type of Structure	Total No.	Compliance		Non-Compliance	
		Day	Night	Day	Night
Buildings (AH, BH, SBH, ND, SND, HUC, garage, shops, car wash station)*	3,692	3,688	3,610	4	82
Canopy	395	395	357	0	38
Sheds	144	144	142	0	2
Container	117	117	105	0	12
Petrol Station	22	22	21	0	1
Mosque	2	2	2	0	0
School	7	7	7	0	0
Total	**4,379**	**4,375**	**4,244**	**4**	**135**

Note: *blank structures are also considered in buildings

Table 6.7: Details of Daytime Non-compliant Structures

No.	X	Y	Chainage (KM)	Structure ID	Building Use	Floor	Area (m^2)	Baseline	Operation	Difference
1	409916.5	4742702.0	59.62		AH	1	20	76.3	79.7	3.4
2	431102.5	4744018.8	27.02		SND	1	14	77.9	81.5	3.6
3	443973.7	4745677.2	24.54	No 32	AH	1	67	77.6	81.1	3.5
4	439000.6	4745008.7	29.62	near No 381	AH	1	65	71.6	74.7	3.1

Table 6.8: Details of Nighttime Non-compliant Structures

No	X	Y	Chainage (KM)	Structure ID	Building Use	F	Area (m^2)	B	O	D
1	445175	4746013	23.28	No 41a	BH	2	388	64.1	67.1	3.0
2	443792	4745570	24.74	No 46	BH	2	60	60.4	63.4	3.0
3	443902	4745690	24.60	near No 61	BH	2	60	45.7	48.7	3.0
4	445504	4745977	22.98	No 8	BH	2	116	65.4	68.4	3.0
5	441343	4745170	27.24	No 207	BH	2	185	64.1	67.1	3.0
6	436315	4744905	32.30	No 155a	BH	2	97	65.4	68.4	3.0
7	429754	4743291	39.16	near No 391	AH	1	25	62.7	66.1	3.4
8	433719	4744736	34.90	No 34/1	Canopy, Service Station	1	65	66.7	69.8	3.1
9	433964	4744744	34.66	No 26	AH	1	60	64.2	67.2	3.0
10	433954	4744747	34.66	near No 26	Canopy	1	52	64.2	67.2	3.0
11	433983	4744747	34.64	near No 24	Garage	1	40	62.1	65.2	3.1
12	433994	4744747	34.62	near No 24	AH	1	55	62.1	65.2	3.1
13	434098	4744748	34.52	No 18	AH	1	115	66.2	69.2	3.0
14	434120	4744759	34.50	No 16	AH	1	43	65.4	68.4	3.0
15	434172	4744758	34.46	near No 12	Canopy	1	44	64.4	67.4	3.0
16	434271	4744765	34.36	No 4	BH	1	72	66.3	69.3	3.0
17	434280	4744767	34.34	near No 2	AH	1	21	58.9	62.0	3.1
18	434308	4744772	34.32	near No 2	Canopy	1	32	62.5	65.6	3.1
19	434525	4744785	34.10	No 194	BH	1	125	62.8	65.8	3.0
20	434112	4744800	34.50	No 15	Canopy	1	47	65.6	68.6	3.0
21	434264	4744809	34.36	No 5	Canopy	1	43	66.9	69.9	3.0

No	X	Y	Chainage (KM)	Structure ID	Building Use	F	Area (m^2)	B	O	D
22	434360	4744815	34.26	No 1a	Canopy	1	57	65.9	68.9	3.0
23	435663	4744835	32.96	near No 142	Shop	1	101	64.9	67.9	3.0
24	436193	4744854	32.44	near No 100	AH	1	209	66.2	69.2	3.0
25	436249	4744853	32.38	No 112	AH	1	218	65.6	68.6	3.0
26	436343	4744855	32.28	No 161	Canopy	1	286	61.0	64.0	3.0
27	436311	4744861	32.30	near No 161	Canopy	1	17	61.0	64.0	3.0
28	436318	4744863	32.30	near No 161	SND	1	11	65.4	68.4	3.0
29	436469	4744861	32.14	near No 92	Container	1	116	62.9	65.9	3.0
30	436795	4744891	31.82		Container	1	14	62.1	65.1	3.0
31	435932	4744895	32.68	near No 175	Container	1	32	64.6	67.7	3.1
32	437051	4744879	31.56	No 66a	Canopy	1	325	67.0	70.0	3.0
33	436081	4744899	32.54	near No167	SND, Shop	1	34	64.8	67.8	3.0
34	436142	4744900	32.48	near No 163	Container	1	121	65.4	68.4	3.0
35	437317	4744908	31.30	near No 64	Container	1	30	67.5	70.5	3.0
36	437329	4744910	31.28	near No 64	SND	1	19	65.0	68.1	3.1
37	436353	4744908	32.26	near No 155	BH	1	129	65.9	68.9	3.0
38	437441	4744915	31.18	near No 60a	Shop	1	32	65.0	68.1	3.1
39	436575	4744919	32.04	near No 147/3		1	10	62.1	65.1	3.0
40	438295	4744930	30.34	near No 16	AH	1	489	64.7	67.7	3.0
41	438258	4744939	30.36	near No 16	Canopy	1	13	64.0	67.1	3.1
42	436978	4744942	31.64	near No 129	SND, Shop	1	130	62.1	65.1	3.0
43	438282	4744940	30.34	near No 16	Canopy	1	14	65.4	68.4	3.0

No	X	Y	Chainage (KM)	Structure ID	Building Use	F	Area (m^2)	B	O	D
44	438512	4744947	30.10	No 14/1	Canopy	1	36	65.9	68.9	3.0
45	439582	4745004	29.04	No 286	AH	1	66	62.2	66.3	4.1
46	439571	4745006	29.04	No 286	Shed	1	33	62.2	66.3	4.1
47	439001	4745009	29.60	near No 381	AH	1	65	65.7	68.7	3.0
48	439628	4745013	29.00	No 284	AH	1	62	66.1	69.1	3.0
49	439666	4745017	28.94	near No 280	Canopy	1	26	65.7	68.7	3.0
50	439695	4745016	28.92	No 278	AH	1	29	65.3	68.3	3.0
51	439789	4745015	28.82	No 274a	BH	1	57	65.4	68.4	3.0
52	439961	4745024	28.66	No 258	SND	1	14	62.6	65.6	3.0
53	440047	4745022	28.56	near No 250a	Canopy	1	35	65.2	68.3	3.1
54	440038	4745027	28.56	near No 250a	AH	1	42	65.2	68.3	3.1
55	440275	4745029	28.34	No 230	Container	1	17	65.4	68.4	3.0
56	439960	4745031	28.66	No 258	Canopy	1	23	67.4	70.4	3.0
57	440424	4745034	28.20		SBH	1	82	65.0	68.0	3.0
58	440654	4745040	27.96	No 214	AH	1	28	64.8	67.8	3.0
59	440787	4745073	27.82		SND	1	14	66.3	69.3	3.0
60	440838	4745071	27.78	No 216a	Canopy	1	267	67.9	70.9	3.0
61	441143	4745108	27.46	No 127	BH	1	358	62.7	65.7	3.0
62	440975	4745107	27.64	No 208	AH	1	38	66.7	69.7	3.0
63	441162	4745108	27.46	No 127	Canopy	1	123	61.3	64.4	3.1
64	441067	4745115	27.54	near No 200	BH	1	22	66.2	69.3	3.1
65	441024	4745114	27.58	near No 204	AH	1	22	64.3	67.3	3.0

No	X	Y	Chainage (KM)	Structure ID	Building Use	F	Area (m^2)	B	O	D
66	441067	4745118	27.54	near No 200	Canopy	1	18	68.0	71.1	3.1
67	441540	4745120	27.08	No 174	SBH	1	135	65.5	68.6	3.1
68	441653	4745122	26.96	No 164	AH	1	54	65.0	68.0	3.0
69	441586	4745126	27.02	No 170	AH	1	77	59.6	62.6	3.0
70	441676	4745123	26.94	No 162	AH	1	66	65.3	68.3	3.0
71	441575	4745126	27.02	No 170	BH	1	105	59.6	62.6	3.0
72	441780	4745127	26.82	No 156a	SND	1	50	61.0	64.4	3.4
73	441794	4745125	26.82	No 156a	Container	1	101	61.0	64.4	3.4
74	441800	4745133	26.82	No 156a	SND	1	18	64.4	67.4	3.0
75	441792	4745133	26.82	No 156a	Canopy	1	42	68.0	71.3	3.3
76	441813	4745133	26.78		SBH	1	54	55.6	58.6	3.0
77	441828	4745134	26.78		SBH	1	78	68.3	71.4	3.1
78	441840	4745137	26.78		SBH	1	59	60.4	63.4	3.0
79	441054	4745157	27.54	near No 217	AH	1	27	62.1	65.2	3.1
80	441321	4745156	27.28	near No 207	Canopy	1	6	65.9	69.0	3.1
81	441113	4745155	27.50	No 213	AH	1	17	65.4	68.4	3.0
82	441582	4745157	27.02		SND	1	14	71.9	75.7	3.8
83	441456	4745157	27.14	near No 201	Canopy	1	61	68.8	71.9	3.1
84	441222	4745162	27.38	No 127a	AH	1	115	65.2	68.3	3.1
85	441632	4745164	26.96	near No 185		1	19	69.2	72.4	3.2
86	442040	4745163	26.56	No 138	BH	1	36	63.8	66.8	3.0
87	442067	4745166	26.56	No 138	BH	1	157	65.6	68.6	3.0

No	X	Y	Chainage (KM)	Structure ID	Building Use	F	Area (m^2)	B	O	D
88	442094	4745169	26.50	No 138	BH	1	138	61.2	64.2	3.0
89	443654	4745487	24.90	No 64	AH	1	71	65.7	68.7	3.0
90	443667	4745496	24.90	No 62	AH	1	46	64.1	67.1	3.0
91	443688	4745510	24.88	No 60	AH, Shed	1	45	65.9	68.9	3.0
92	443787	4745567	24.76	No 48	AH	1	93	67.0	70.0	3.0
93	443811	4745587	24.72	No 44a	BH	1	45	63.1	66.1	3.0
94	443857	4745657	24.64	No 65	Canopy	1	91	66.1	69.1	3.0
95	443895	4745679	24.60	No 61	AH	1	45	63.6	66.7	3.1
96	443974	4745677	24.54	No 32	AH	1	67	71.5	75.3	3.8
97	443910	4745685	24.60	near No 61	SND	1	13	67.3	70.3	3.0
98	443913	4745686	24.60	near No 61	Canopy	1	8	67.7	70.7	3.0
99	443942	4745702	24.56	near No 57	AH	1	23	66.9	69.9	3.0
100	444091	4745718	24.40	No 14	SND	1	17	61.3	64.4	3.1
101	444103	4745719	24.40	No 14	HUC	1	61	65.5	68.5	3.0
102	444262	4745807	24.22	No 83a	AH	1	75	65.7	68.7	3.0
103	444403	4745850	24.06	No 81	Petrol Station	1	166	64.7	67.8	3.1
104	444425	4745843	24.06	No 81	Canopy	1	210	63.9	67.0	3.1
105	444645	4745900	23.82	near No 77	Canopy	1	34	65.8	68.8	3.0
106	444644	4745905	23.82	near No 77	Container	1	55	63.2	66.2	3.0
107	444689	4745905	23.78	No 75a	Canopy	1	35	68.6	71.7	3.1
108	444699	4745909	23.78	No 75a	Canopy	1	14	66.9	69.9	3.0
109	444707	4745914	23.76	No 75a	BH	1	207	62.7	65.7	3.0

No	X	Y	Chainage (KM)	Structure ID	Building Use	F	Area (m^2)	B	O	D
110	445338	4745969	23.14	No 26	Container	1	15	65.1	68.1	3.0
111	445380	4745971	23.10	No 20	Canopy	1	18	65.1	68.2	3.1
112	445753	4745989	22.72		AH, Shop	1	56	65.0	68.1	3.1
113	445597	4745993	22.86	near No 2	SND	1	14	68.0	71.1	3.1
114	446546	4745998	21.92	near No 160	SND	1	14	66.9	69.9	3.0
115	445320	4746011	23.14	No 35	BH, Shop	1	37	65.0	68.0	3.0
116	445429	4746016	23.04	No 31a	Container	1	38	67.9	71.0	3.1
117	446067	4746034	22.40	No 17	AH	1	24	65.6	68.7	3.1
118	445937	4746031	22.52	No 23	AH	1	33	66.2	69.2	3.0
119	446107	4746037	22.36	No 13	AH	1	99	65.5	68.5	3.0
120	446139	4746039	22.32	No 9	Canopy	1	76	62.9	65.9	3.0
121	445834	4746040	22.64	No 1	Container	1	27	65.2	68.2	3.0
122	446082	4746041	22.38	No 15	Container	1	49	65.2	68.3	3.1
123	446848	4746100	21.60	No 117	AH	1	118	64.3	67.3	3.0
124	448437	4746398	19.98		Canopy	1	63	62.8	65.8	3.0
125	445248	4746009	23.22	No 41	Canopy	1	122	66.3	69.3	3.0
126	445215	4746007	23.24	No 41a	Canopy	1	271	65.1	68.1	3.0
127	443758	4745606	24.76	near No 71	Canopy	1	141	66.5	69.5	3.0
128	446205	4746024	22.26	near No 3	Canopy	1	21	66.3	69.3	3.0
129	437246	4744954	31.36	No 115	BH	2	75	62.2	65.2	3.0
130	433987	4744793	34.64	near No 23	Canopy	1	47	57.7	60.8	3.1
131	434309	4744809	34.30	No 3	Canopy	1	61	62.8	65.8	3.0

No	X	Y	Chainage (KM)	Structure ID	Building Use	F	Area (m^2)	B	O	D
132	443984	4745726	24.50	No 55	AH	1	81	61.9	65.0	3.1
133	409917	4742702	59.62		AH	1	20	60.7	63.8	3.1
134	434043	4744754	34.58	No 20	BH, Shop	1	31	66.2	69.2	3.0
135	439693	4745022	28.92	No 278	Canopy	1	8	60.9	63.9	3.0

F = Floor, B = Baseline, O = Operation, D = Difference

6.5 Mitigation Options

50. If the noise levels exceed the desired criteria, abatement options are introduced. A set of abatement measures was considered to see their possible effectiveness. The abatement measures are designed to achieve compliance in year 2035. Following the instruction of the Client these include the following:

6.5.1 Pavement Modification (PM)

51. 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 6.9** provides the pavement options.

Table 6.9: 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)

52. Noise is directly related to the speed of the vehicle. The lower the speed the lower the noise level. **Table 6.10** provides the speed options.

Table 6.10: Speed Options

Speed Options	Road Section	Vehicle Speed (km/h)	Reduction in Noise (approx.)
SR1	KM15.9-KM19.0	75	- 0.5 to 0.6 dBA
	KM19.0-KM61.0	55	
SR2	KM15.9-KM19.0	70	- 1.0 to 1.3 dBA
	KM19.0-KM61.0	50	

6.5.3 Combination

53. 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 6.11** provides the combination.

Table 6.11: Combinations

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

6.6 Compliance Status after Suggested Mitigations

54. **Table 6.12** and **Table 6.13** provides the compliance status of non-compliant structures both during day and night after applying suggested mitigations.

55. It can be seen in **Table 6.12** and **Table 6.13** that when pavement option 2 (Porous asphalt; pores >15% 0/11) is applied the operational noise levels will drop down from the baseline noise levels which is why the difference of operational noise level, after mitigation, from the baseline is in negative.

Table 6.12: Compliance Status after Mitigation – Daytime

No.	X	Y	Chainage (KM)	SR1		SR2		PM1		PM2	
				DAM	CS	DAM	CS	DAM	CS	DAM	CS
1	409916.5	4742702.0	59.62	2.8	C	2.3	C	1.4	C	-0.6	C
2	441582.1	4745156.9	27.02	3.0	C	2.4	C	1.6	C	-0.4	C
3	443973.7	4745677.2	24.54	2.9	C	2.3	C	1.5	C	-0.5	C
4	439000.6	4745008.7	29.62	2.5	C	2.0	C	1.1	C	-0.9	C

SR1 = Speed Reduction 1 SR2 = Speed Reduction 2 PM1 = Pavement Modification 1 PM2 = Pavement Modification 2
C = Compliant NC = Non-compliant CS = Compliance Status DAM = Difference of noise level from baseline after mitigation
X=latitude y=longitude

Table 6.13: Compliance Status after Mitigation – Nighttime

No	X	Y	Chainage (KM)	SR1		SR2		PM1		PM2	
				DAM	CS	DAM	CS	DAM	CS	DAM	CS
1	445175	4746013	23.28	2.4	C	1.8	C	1.0	C	-1.0	C
2	443792	4745570	24.74	2.3	C	1.7	C	1.0	C	-1.0	C
3	443902	4745690	24.60	2.4	C	1.7	C	1.0	C	-1.0	C
4	445504	4745977	22.98	1.8	C	1.2	C	1.0	C	-1.0	C
5	441343	4745170	27.24	2.4	C	1.8	C	1.0	C	-1.0	C
6	436315	4744905	32.30	1.8	C	1.2	C	1.0	C	-1.0	C
7	429754	4743291	39.16	1.1	C	0.6	C	1.4	C	-0.6	C
8	433719	4744736	34.90	2.4	C	1.7	C	1.1	C	-0.9	C
9	433964	4744744	34.66	1.7	C	1.1	C	1.0	C	-1.0	C
10	433954	4744747	34.66	1.7	C	1.1	C	1.0	C	-1.0	C
11	433983	4744747	34.64	2.1	C	1.5	C	1.1	C	-0.9	C
12	433994	4744747	34.62	2.1	C	1.5	C	1.1	C	-0.9	C
13	434098	4744748	34.52	1.7	C	1.2	C	1.0	C	-1.0	C
14	434120	4744759	34.50	1.8	C	1.2	C	1.0	C	-1.0	C
15	434172	4744758	34.46	1.9	C	1.3	C	1.0	C	-1.0	C
16	434271	4744765	34.36	1.9	C	1.3	C	1.0	C	-1.0	C
17	434280	4744767	34.34	1.9	C	1.3	C	1.1	C	-0.9	C
18	434308	4744772	34.32	1.5	C	0.9	C	1.1	C	-0.9	C
19	434525	4744785	34.10	1.9	C	1.2	C	1.0	C	-1.0	C
20	434112	4744800	34.50	1.6	C	1.0	C	1.0	C	-1.0	C
21	434264	4744809	34.36	1.8	C	1.2	C	1.0	C	-1.0	C
22	434360	4744815	34.26	1.3	C	0.8	C	1.0	C	-1.0	C
23	435663	4744835	32.96	2.3	C	1.7	C	1.0	C	-1.0	C
24	436193	4744854	32.44	1.7	C	1.2	C	1.0	C	-1.0	C
25	436249	4744853	32.38	1.6	C	1.0	C	1.0	C	-1.0	C
26	436343	4744855	32.28	1.0	C	0.5	C	1.0	C	-1.0	C
27	436311	4744861	32.30	1.0	C	0.5	C	1.0	C	-1.0	C
28	436318	4744863	32.30	1.8	C	1.2	C	1.0	C	-1.0	C
29	436469	4744861	32.14	1.8	C	1.2	C	1.0	C	-1.0	C
30	436795	4744891	31.82	2.1	C	1.5	C	1.0	C	-1.0	C
31	435932	4744895	32.68	1.6	C	1.0	C	1.1	C	-0.9	C
32	437051	4744879	31.56	1.8	C	1.2	C	1.0	C	-1.0	C

No	X	Y	Chainage (KM)	SR1		SR2		PM1		PM2	
				DAM	CS	DAM	CS	DAM	CS	DAM	CS
33	436081	4744899	32.54	1.4	C	0.8	C	1.0	C	-1.0	C
34	436142	4744900	32.48	1.8	C	1.2	C	1.0	C	-1.0	C
35	437317	4744908	31.30	1.4	C	0.8	C	1.0	C	-1.0	C
36	437329	4744910	31.28	1.9	C	1.3	C	1.1	C	-0.9	C
37	436353	4744908	32.26	1.3	C	0.8	C	1.0	C	-1.0	C
38	437441	4744915	31.18	1.9	C	1.3	C	1.1	C	-0.9	C
39	436575	4744919	32.04	2.1	C	1.5	C	1.0	C	-1.0	C
40	438295	4744930	30.34	1.8	C	1.2	C	1.0	C	-1.0	C
41	438258	4744939	30.36	1.6	C	1.1	C	1.1	C	-0.9	C
42	436978	4744942	31.64	2.1	C	1.5	C	1.0	C	-1.0	C
43	438282	4744940	30.34	1.8	C	1.2	C	1.0	C	-1.0	C
44	438512	4744947	30.10	1.3	C	0.8	C	1.0	C	-1.0	C
45	439582	4745004	29.04	2.1	C	1.4	C	2.1	C	0.1	C
46	439571	4745006	29.04	2.1	C	1.4	C	2.1	C	0.1	C
47	439001	4745009	29.60	1.9	C	1.2	C	1.0	C	-1.0	C
48	439628	4745013	29.00	1.7	C	1.1	C	1.0	C	-1.0	C
49	439666	4745017	28.94	1.9	C	1.2	C	1.0	C	-1.0	C
50	439695	4745016	28.92	2.4	C	1.8	C	1.0	C	-1.0	C
51	439789	4745015	28.82	1.8	C	1.2	C	1.0	C	-1.0	C
52	439961	4745024	28.66	2.1	C	1.4	C	1.0	C	-1.0	C
53	440047	4745022	28.56	2.4	C	1.7	C	1.1	C	-0.9	C
54	440038	4745027	28.56	2.4	C	1.7	C	1.1	C	-0.9	C
55	440275	4745029	28.34	1.8	C	1.2	C	1.0	C	-1.0	C
56	439960	4745031	28.66	2.3	C	1.7	C	1.0	C	-1.0	C
57	440424	4745034	28.20	1.9	C	1.3	C	1.0	C	-1.0	C
58	440654	4745040	27.96	1.4	C	0.8	C	1.0	C	-1.0	C
59	440787	4745073	27.82	1.9	C	1.3	C	1.0	C	-1.0	C
60	440838	4745071	27.78	2.4	C	1.8	C	1.0	C	-1.0	C
61	441143	4745108	27.46	1.1	C	0.6	C	1.0	C	-1.0	C
62	440975	4745107	27.64	1.9	C	1.2	C	1.0	C	-1.0	C
63	441162	4745108	27.46	1.9	C	1.2	C	1.1	C	-0.9	C
64	441067	4745115	27.54	1.7	C	1.2	C	1.1	C	-0.9	C
65	441024	4745114	27.58	1.9	C	1.3	C	1.0	C	-1.0	C
66	441067	4745118	27.54	2.4	C	1.8	C	1.1	C	-0.9	C

No	X	Y	Chainage (KM)	SR1		SR2		PM1		PM2	
				DAM	CS	DAM	CS	DAM	CS	DAM	CS
67	441540	4745120	27.08	1.9	C	1.2	C	1.1	C	-0.9	C
68	441653	4745122	26.96	1.9	C	1.3	C	1.0	C	-1.0	C
69	441586	4745126	27.02	1.6	C	1.0	C	1.0	C	-1.0	C
70	441676	4745123	26.94	2.4	C	1.8	C	1.0	C	-1.0	C
71	441575	4745126	27.02	1.6	C	1.0	C	1.0	C	-1.0	C
72	441780	4745127	26.82	1.0	C	0.5	C	1.4	C	-0.6	C
73	441794	4745125	26.82	1.0	C	0.5	C	1.4	C	-0.6	C
74	441800	4745133	26.82	1.9	C	1.3	C	1.0	C	-1.0	C
75	441792	4745133	26.82	2.4	C	1.8	C	1.3	C	-0.7	C
76	441813	4745133	26.78	0.8	C	0.3	C	1.0	C	-1.0	C
77	441828	4745134	26.78	2.4	C	1.7	C	1.1	C	-0.9	C
78	441840	4745137	26.78	2.3	C	1.7	C	1.0	C	-1.0	C
79	441054	4745157	27.54	2.1	C	1.5	C	1.1	C	-0.9	C
80	441321	4745156	27.28	1.3	C	0.8	C	1.1	C	-0.9	C
81	441113	4745155	27.50	1.8	C	1.2	C	1.0	C	-1.0	C
82	441582	4745157	27.02	3.2	NC	2.6	C	1.8	C	-0.2	C
83	441456	4745157	27.14	2.4	C	1.8	C	1.1	C	-0.9	C
84	441222	4745162	27.38	2.4	C	1.7	C	1.1	C	-0.9	C
85	441632	4745164	26.96	1.9	C	1.3	C	1.2	C	-0.8	C
86	442040	4745163	26.56	1.8	C	1.2	C	1.0	C	-1.0	C
87	442067	4745166	26.56	1.6	C	1.0	C	1.0	C	-1.0	C
88	442094	4745169	26.50	1.1	C	0.5	C	1.0	C	-1.0	C
89	443654	4745487	24.90	1.9	C	1.2	C	1.0	C	-1.0	C
90	443667	4745496	24.90	2.4	C	1.8	C	1.0	C	-1.0	C
91	443688	4745510	24.88	1.3	C	0.8	C	1.0	C	-1.0	C
92	443787	4745567	24.76	1.8	C	1.2	C	1.0	C	-1.0	C
93	443811	4745587	24.72	2.4	C	1.8	C	1.0	C	-1.0	C
94	443857	4745657	24.64	1.7	C	1.1	C	1.0	C	-1.0	C
95	443895	4745679	24.60	2.5	C	1.8	C	1.1	C	-0.9	C
96	443974	4745677	24.54	3.2	NC	2.5	C	1.8	C	-0.2	C
97	443910	4745685	24.60	1.8	C	1.2	C	1.0	C	-1.0	C
98	443913	4745686	24.60	2.4	C	1.8	C	1.0	C	-1.0	C
99	443942	4745702	24.56	1.8	C	1.2	C	1.0	C	-1.0	C
100	444091	4745718	24.40	1.9	C	1.2	C	1.1	C	-0.9	C

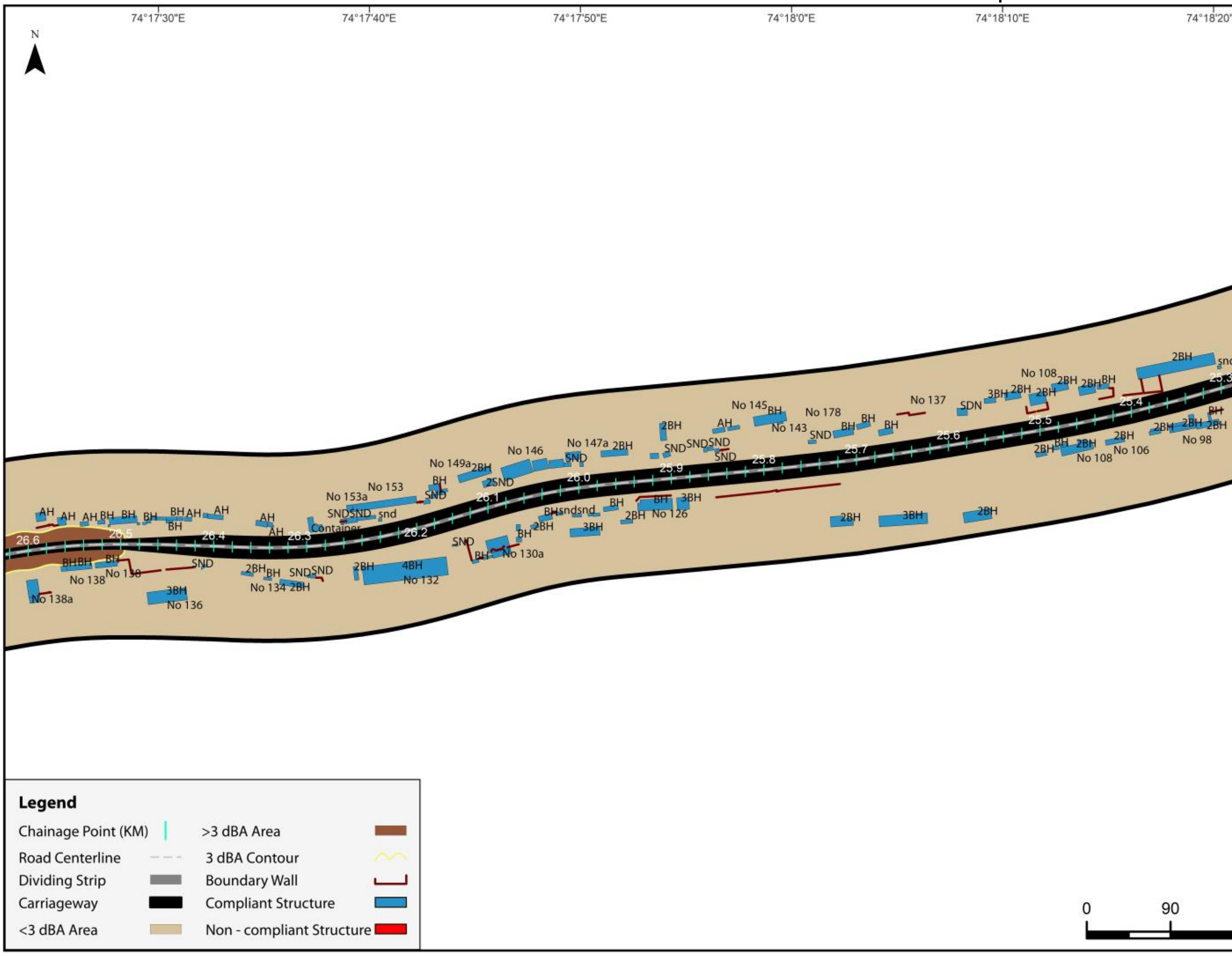
No	X	Y	Chainage (KM)	SR1		SR2		PM1		PM2	
				DAM	CS	DAM	CS	DAM	CS	DAM	CS
101	444103	4745719	24.40	1.9	C	1.2	C	1.0	C	-1.0	C
102	444262	4745807	24.22	1.9	C	1.2	C	1.0	C	-1.0	C
103	444403	4745850	24.06	1.8	C	1.2	C	1.1	C	-0.9	C
104	444425	4745843	24.06	1.1	C	0.6	C	1.1	C	-0.9	C
105	444645	4745900	23.82	1.2	C	0.7	C	1.0	C	-1.0	C
106	444644	4745905	23.82	2.0	C	1.4	C	1.0	C	-1.0	C
107	444689	4745905	23.78	2.5	C	1.9	C	1.1	C	-0.9	C
108	444699	4745909	23.78	1.8	C	1.2	C	1.0	C	-1.0	C
109	444707	4745914	23.76	1.1	C	0.6	C	1.0	C	-1.0	C
110	445338	4745969	23.14	1.6	C	1.0	C	1.0	C	-1.0	C
111	445380	4745971	23.10	1.6	C	1.0	C	1.1	C	-0.9	C
112	445753	4745989	22.72	1.9	C	1.3	C	1.1	C	-0.9	C
113	445597	4745993	22.86	2.4	C	1.8	C	1.1	C	-0.9	C
114	446546	4745998	21.92	1.8	C	1.2	C	1.0	C	-1.0	C
115	445320	4746011	23.14	1.9	C	1.3	C	1.0	C	-1.0	C
116	445429	4746016	23.04	2.4	C	1.8	C	1.1	C	-0.9	C
117	446067	4746034	22.40	1.6	C	1.0	C	1.1	C	-0.9	C
118	445937	4746031	22.52	1.7	C	1.2	C	1.0	C	-1.0	C
119	446107	4746037	22.36	1.9	C	1.2	C	1.0	C	-1.0	C
120	446139	4746039	22.32	1.8	C	1.2	C	1.0	C	-1.0	C
121	445834	4746040	22.64	2.4	C	1.7	C	1.0	C	-1.0	C
122	446082	4746041	22.38	2.4	C	1.7	C	1.1	C	-0.9	C
123	446848	4746100	21.60	1.9	C	1.3	C	1.0	C	-1.0	C
124	448437	4746398	19.98	1.9	C	1.2	C	1.0	C	-1.0	C
125	445248	4746009	23.22	1.9	C	1.3	C	1.0	C	-1.0	C
126	445215	4746007	23.24	1.6	C	1.0	C	1.0	C	-1.0	C
127	443758	4745606	24.76	1.3	C	0.7	C	1.0	C	-1.0	C
128	446205	4746024	22.26	1.9	C	1.3	C	1.0	C	-1.0	C
129	437246	4744954	31.36	2.1	C	1.4	C	1.0	C	-1.0	C
130	433987	4744793	34.64	2.0	C	1.4	C	1.1	C	-0.9	C
131	434309	4744809	34.30	1.9	C	1.2	C	1.0	C	-1.0	C
132	443984	4745726	24.50	2.0	C	1.4	C	1.1	C	-0.9	C
133	409917	4742702	59.62	2.1	C	0.5	C	1.1	C	-0.9	C
134	434043	4744754	34.58	1.7	C	1.2	C	1.0	C	-1.0	C

No	X	Y	Chainage (KM)	SR1		SR2		PM1		PM2	
				DAM	CS	DAM	CS	DAM	CS	DAM	CS
135	439693	4745022	28.92	1.7	C	0.4	C	1.0	C	-1.0	C

SR1 = Speed Reduction 1 SR2 = Speed Reduction 2 PM1 = Pavement Modification
PM2 = Pavement Modification 2 C = Compliant NC = Non-compliant
CS = Compliance Status DAM = Difference of noise level from baseline after mitigation

6.7 Anomalies in Compliance

56. In sections from KM15.9 to KM19.0 and KM25.0 to KM26.5 there are no compliance issues at all. This is because there are a greater number of lanes, resulting in the reduction of noise at the receptors by about 0.5 dBA. This is because more lanes increases the distance between the source and receptors



57. **Figure** 6.1.

6.8 Conclusion

58. All non-compliant structures during day come into compliance after applying SR2 mitigation or PM1 mitigation whereas all the non-compliant structures during night come in compliance after applying SR1 mitigation or PM1 mitigation (Table 6.9 and Table 6.10).

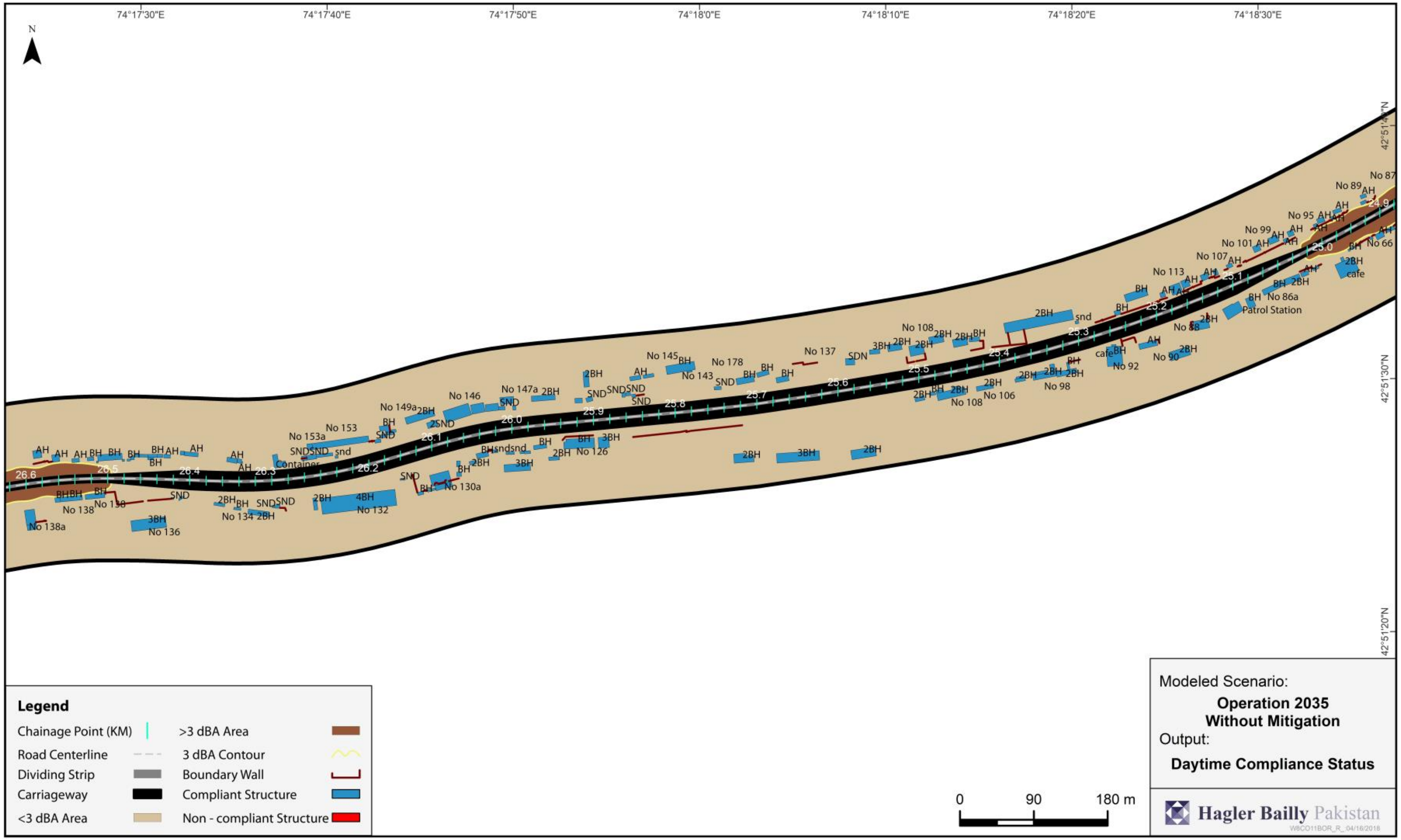


Figure 6.1: Anomaly Section: km 24.9-26.6 - Example

7 Recommendations

7.1 Preconstruction Period

59. The simulated noise levels for the present road conditions (very rough), 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.

60. The baseline noise levels exceed the Kyrgyz and IFC day and nighttime limit by an average of 13 dBA and 17 dBA, respectively.

7.2 Construction Period

61. 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 5.2 dBA and 8.7 dBA, during Typical and Extreme Configurations conditions, respectively. If work at night is needed the 'Typical Configuration" should be the prevailing configuration with the suggested mitigation measured described in Section 5.4 in-place.

7.3 Operating Period

62. During the Operating Period, noise reduction will be best achieved by applying the pavement modification option over the speed reduction option as people may regularly exceed the speed limit resulting in noise levels exceeding the standards. Also, the highway is made for the purpose of providing high speeds to the users and to reduce the travelling time. If the speed is lowered to around 50 km/h then the purpose of the highway is not be served.

63. That being said maintaining a design speed between 55 and 60 km/h will reduce the operating period noise environment by 1.1 to 1.3 dBA, for combined reduction of about 3.3 dBA at all times.

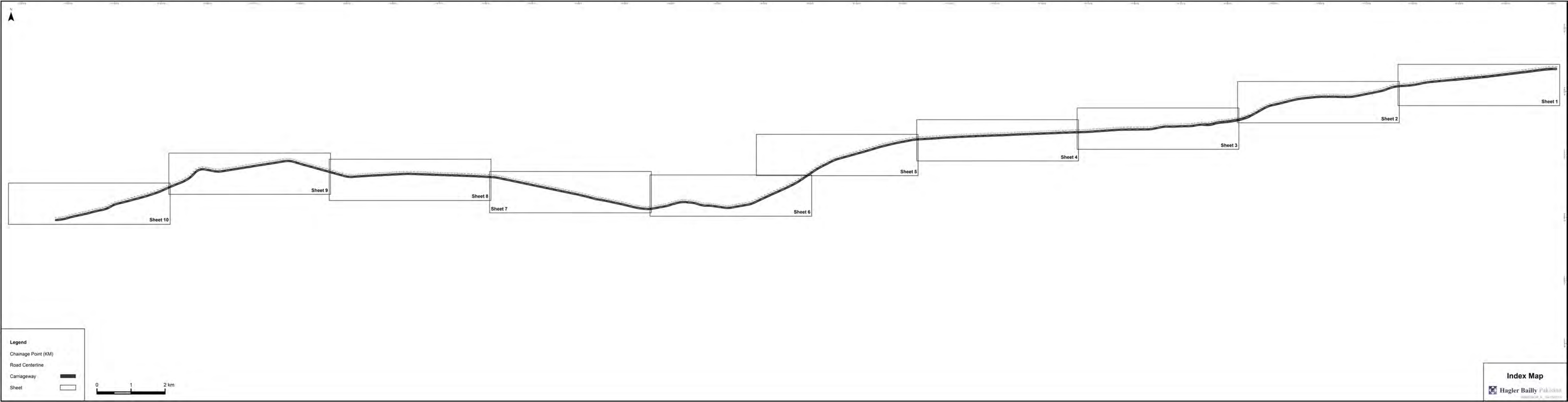
64. Of the approximately 4,379 structures along the 45.1 km long corridor, and without any mitigation and when applying trhe IFC +3 dBA standard, four will be non compliant during the daytime and 135 during night. These structures are identified by their lat. and long coordinates (Table 6.12 and Table 6.13).

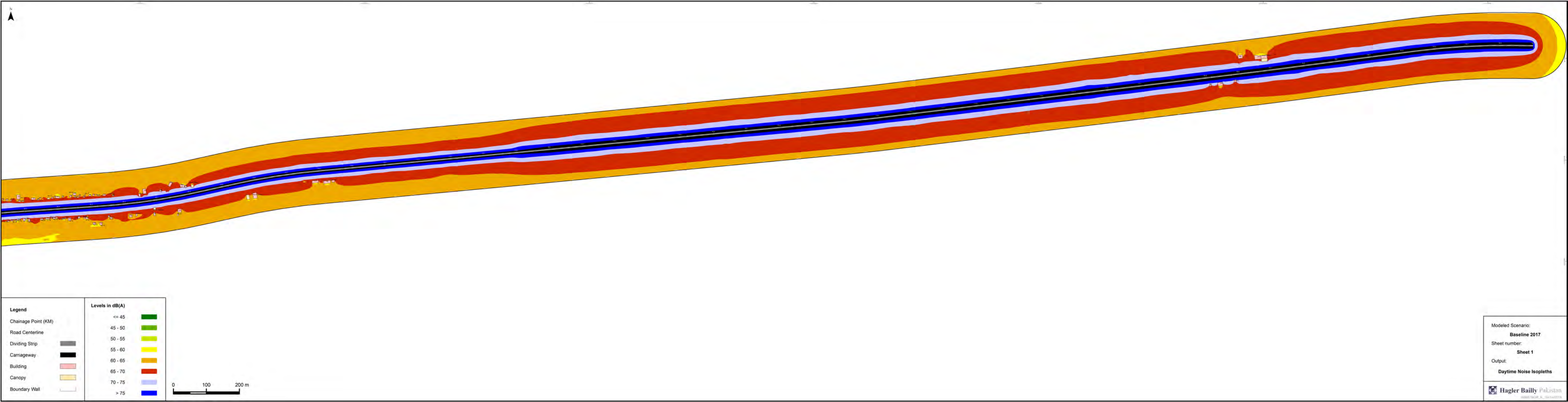
65. With the low noise pavement mitigation measure applied and speed maintained below 70 km/h, the 139 non-compliant cases come into compliance.

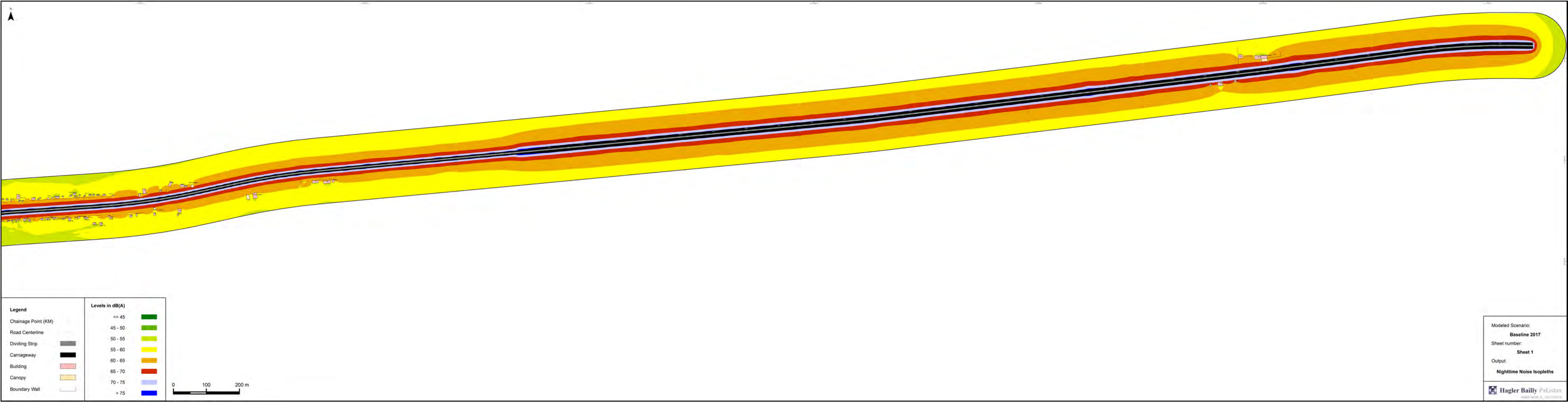
66. To reduce the risk of exceedance of the IFC +3 dBA standard combination of the PM1 noise reducing pavement formulation as defined in Table 6.9 and SR1 speed control measure defined in Table 6.10 is recommended.

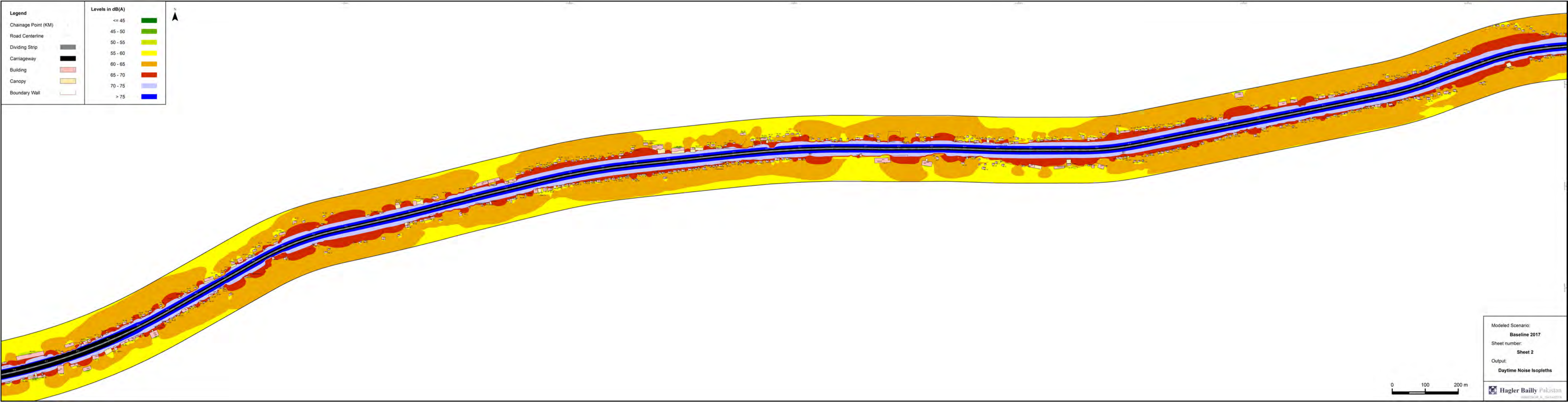
ANNEXURE I: BASELINE OUTPUTS

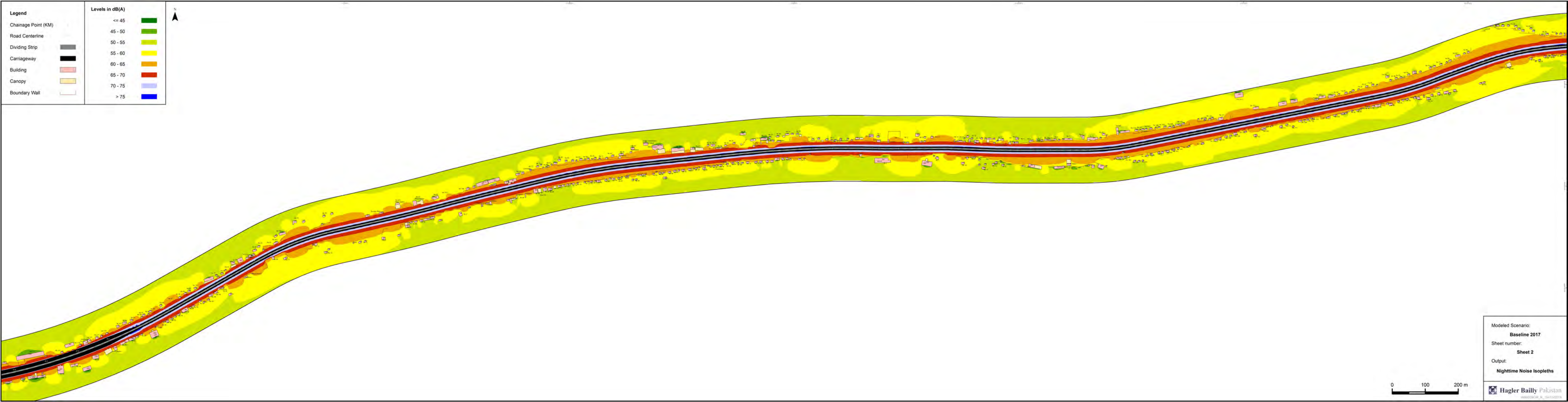
1. See following pages.


Sheet 1
Sheet 2
Sheet 3
Sheet 4
Sheet 5
Sheet 6
Sheet 7
Sheet 8
Sheet 9
Sheet 10
Legend
Chainage Point (KM)
Road Centerline
Carriageway
Sheet
0
1
2 km
Index Map
Hagler Bailly Pakistan

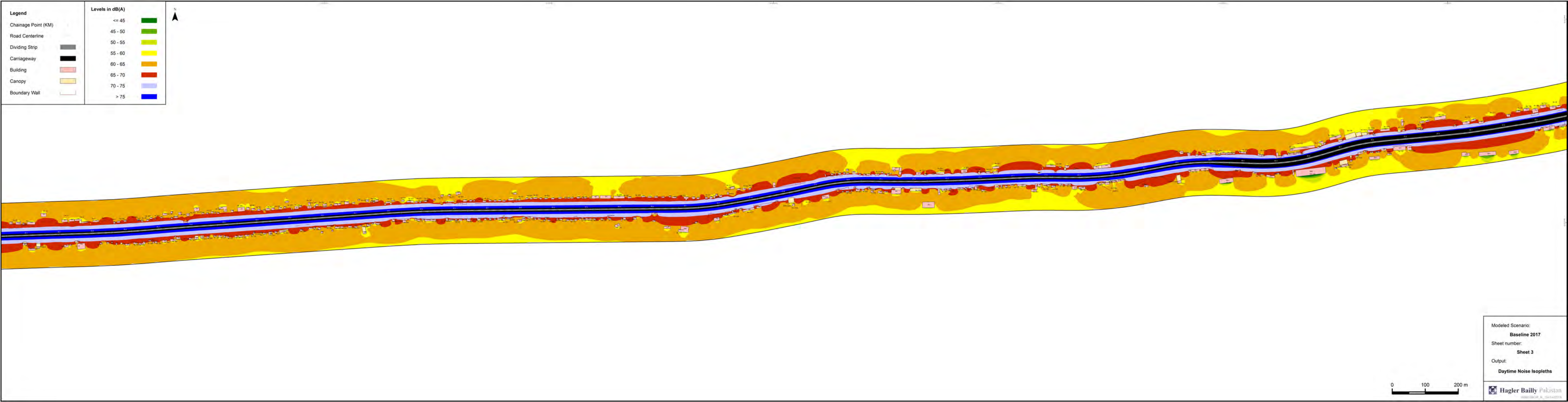

Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
Building
Canopy
Boundary Wall
Levels in dB(A)
<= 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
> 75
0
100
200 m
Modeled Scenario:
Baseline 2017
Sheet number:
Sheet 1
Output:
Daytime Noise Isopleths
Hagler Bailly Pakistan

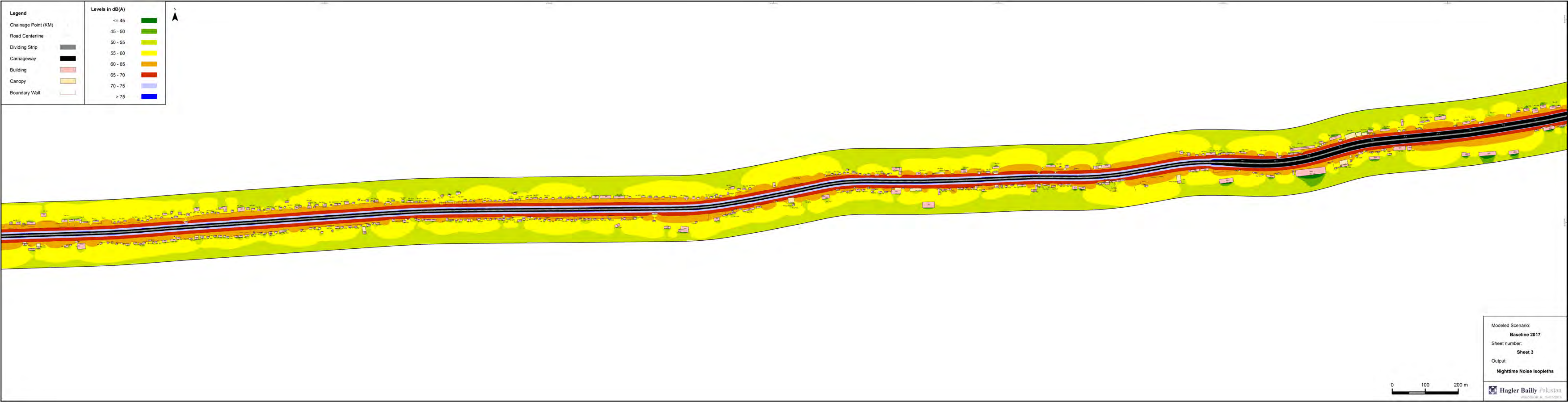

N
Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
Building
Canopy
Boundary Wall
Levels in dB(A)
<= 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
> 75
0
100
200 m
Modeled Scenario:
Baseline 2017
Sheet number:
Sheet 1
Output:
Nighttime Noise Isopleths
Hagler Bailly Pakistan

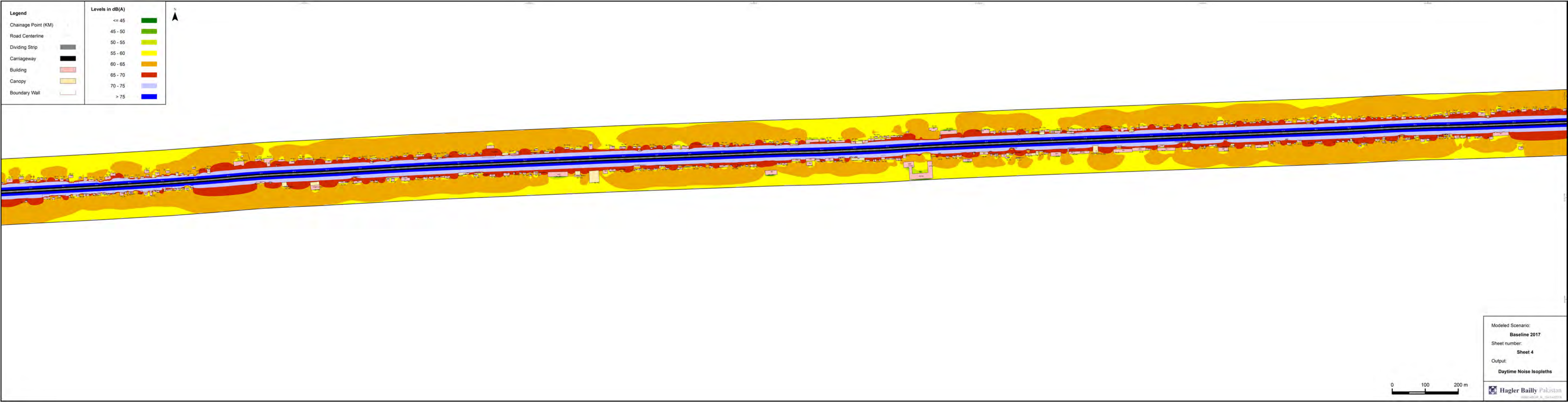

Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
Building
Canopy
Boundary Wall
Levels in dB(A)
<= 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
> 75
0
100
200 m
Modeled Scenario:
Baseline 2017
Sheet number:
Sheet 2
Output:
Daytime Noise Isopleths
Hagler Bailly Pakistan



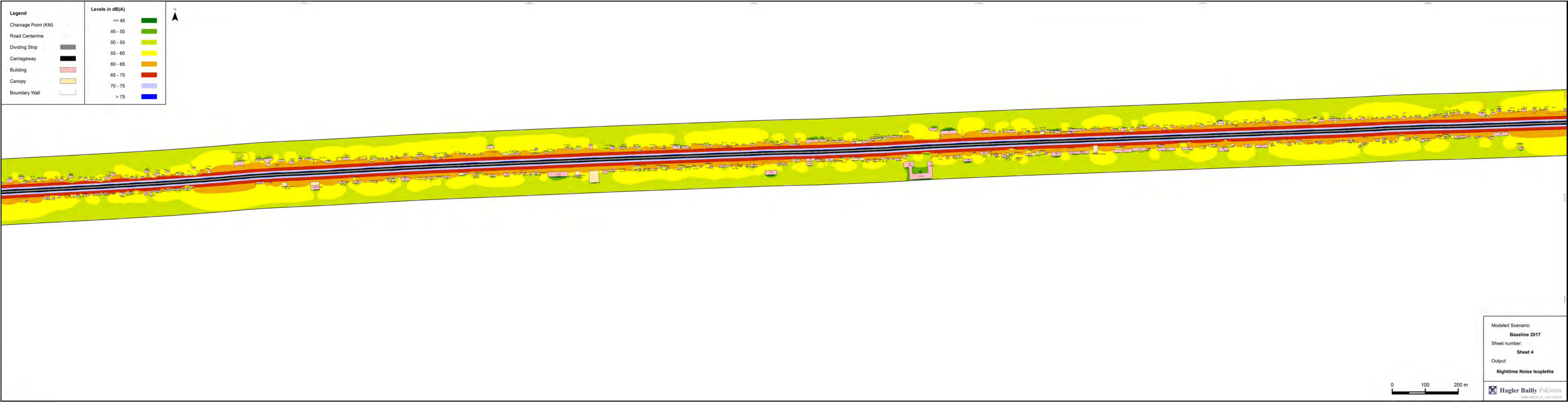
Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
Building
Canopy
Boundary Wall
Levels in dB(A)
<= 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
> 75
0
100
200 m
Modeled Scenario:
Baseline 2017
Sheet number:
Sheet 2
Output:
Nighttime Noise Isopleths
Hagler Bailly Pakistan

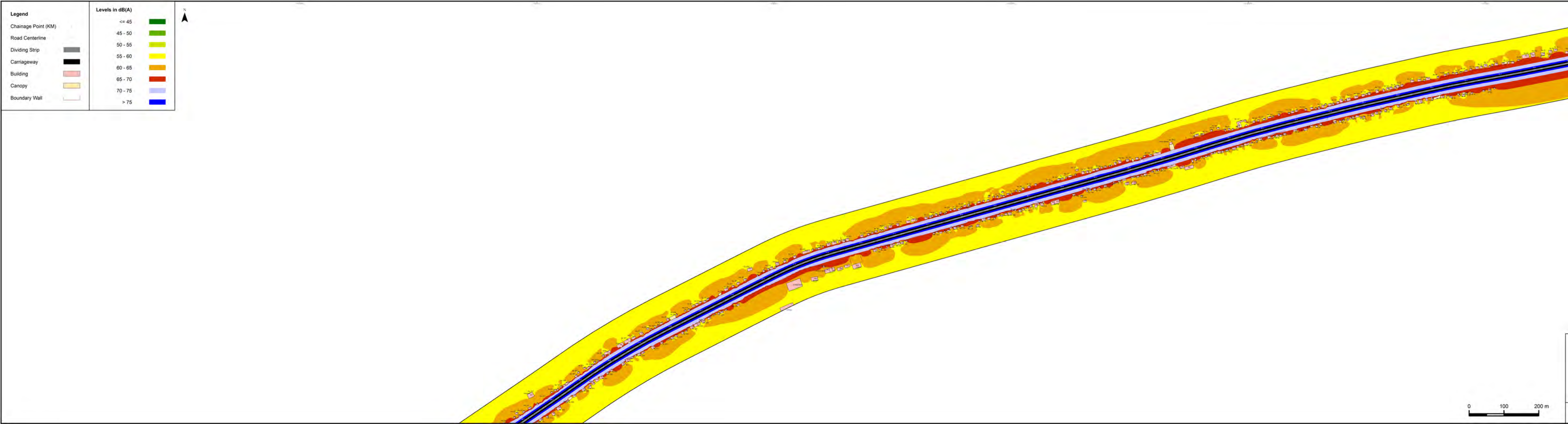

Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
Building
Canopy
Boundary Wall
Levels in dB(A)
<= 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
> 75
0
100
200 m
Modeled Scenario:
Baseline 2017
Sheet number:
Sheet 3
Output:
Daytime Noise Isopleths
Hagler Bailly Pakistan


Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
Building
Canopy
Boundary Wall
Levels in dB(A)
<= 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
> 75
N
0
100
200 m
Modeled Scenario:
Baseline 2017
Sheet number:
Sheet 3
Output:
Nighttime Noise Isopleths
Hagler Bailly Pakistan



Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
Building
Canopy
Boundary Wall
Levels in dB(A)
<= 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
> 75
N
0
100
200 m
Modeled Scenario:
Baseline 2017
Sheet number:
Sheet 4
Output:
Daytime Noise Isopleths
Hagler Bailly Pakistan


Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
Building
Canopy
Boundary Wall
Levels in dB(A)
<= 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
> 75
0
100
200 m
Modeled Scenario:
Baseline 2017
Sheet number:
Sheet 4
Output:
Nighttime Noise Isopleths
Hagler Bailly Pakistan



Modeled Scenario:

Baseline 2017

Sheet number:

Sheet 5

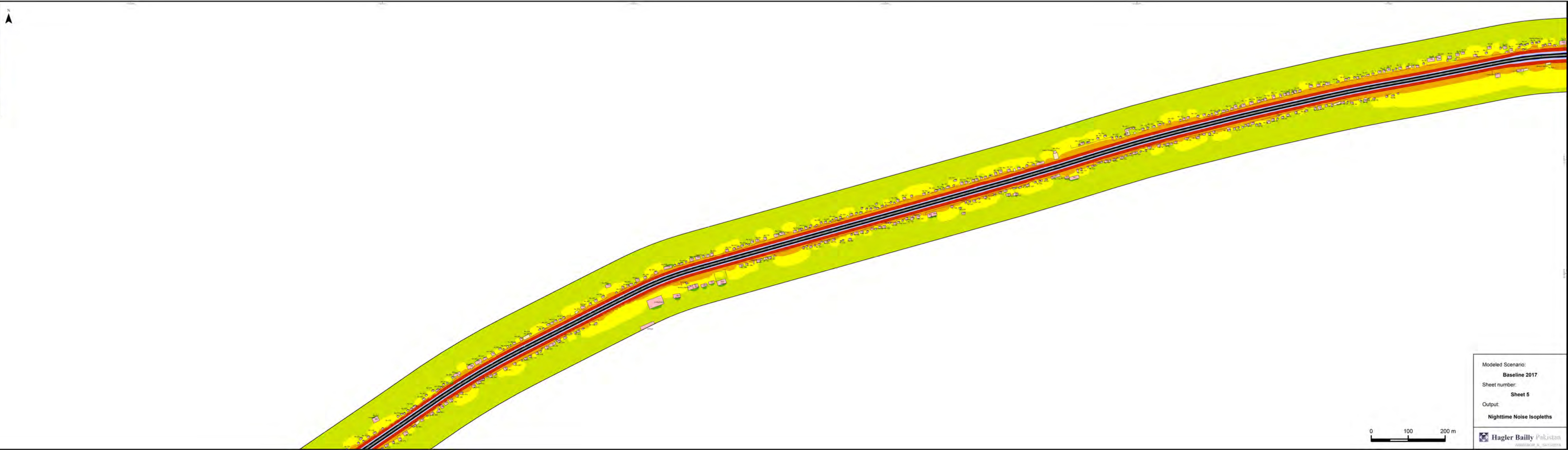
Output:

Daytime Noise Isopleths

Hagler Bailly Pakistan

Legend	
Chainage Point (KM)	
Road Centerline	
Dividing Strip	
Carriageway	
Building	
Canopy	
Boundary Wall	

Levels in dB(A)	
<= 45	
45 - 50	
50 - 55	
55 - 60	
60 - 65	
65 - 70	
70 - 75	
> 75	



Modeled Scenario:

Baseline 2017

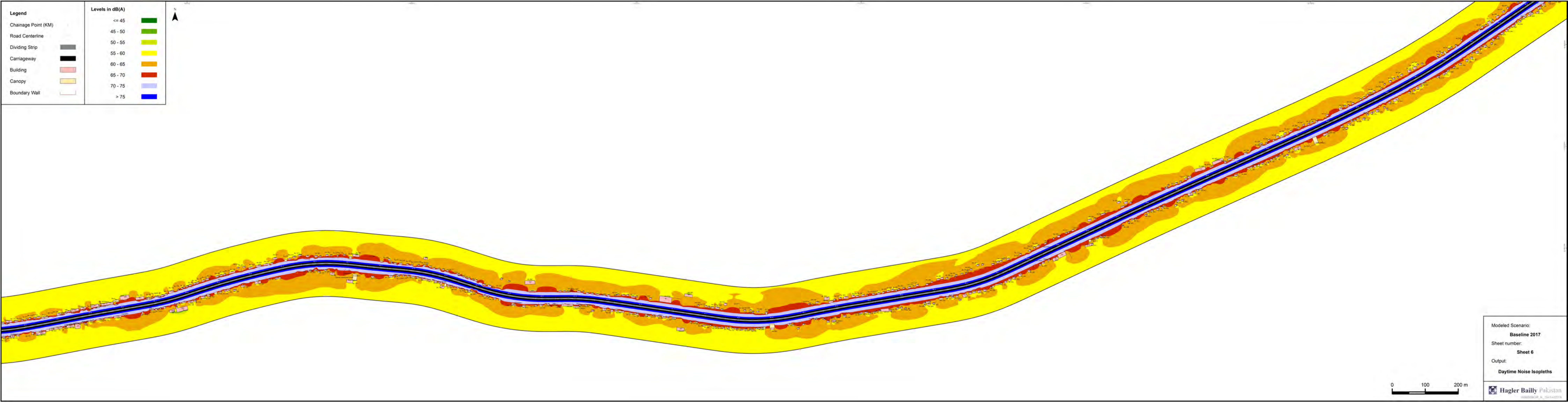
Sheet number:

Sheet 5

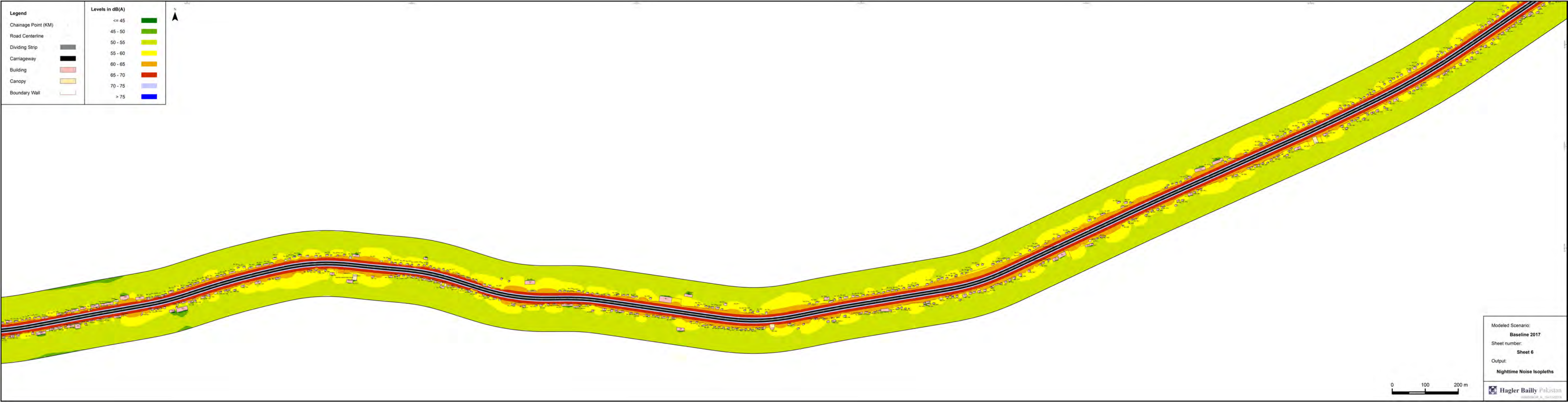
Output:

Nighttime Noise Isopleths

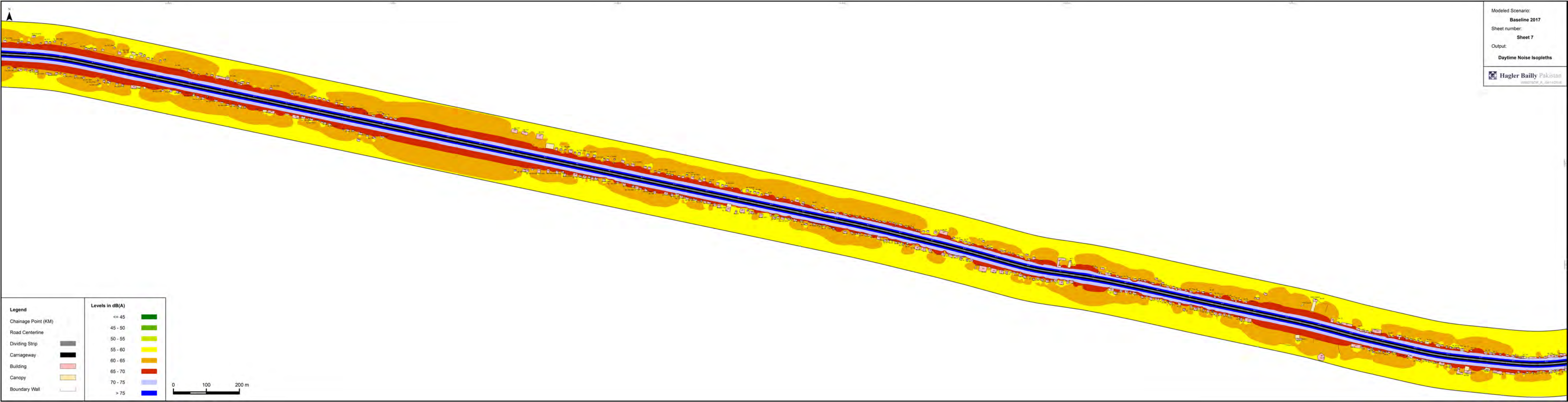
Hagler Bailly Pakistan

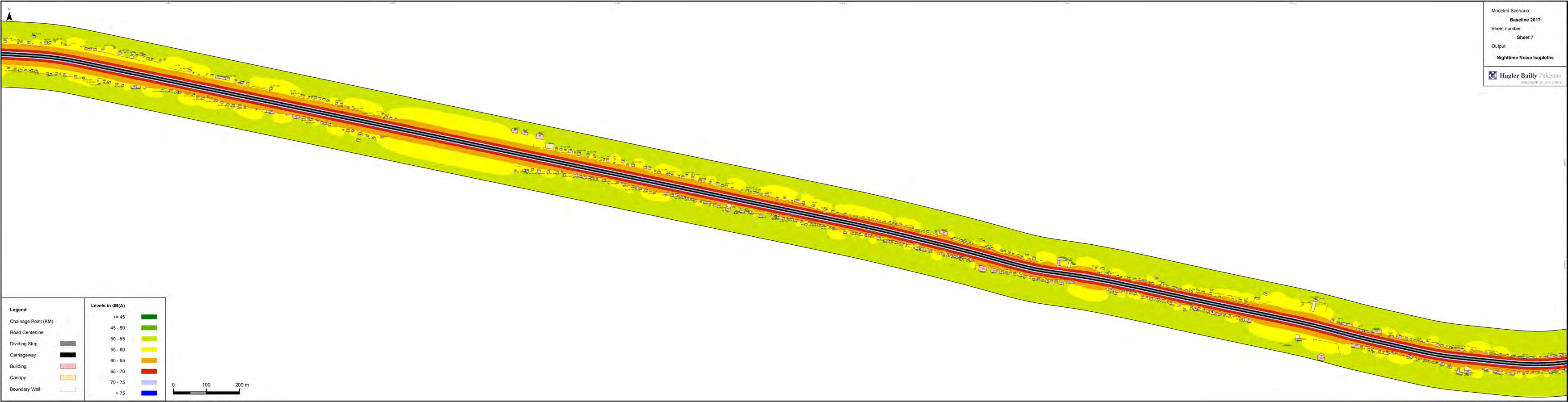


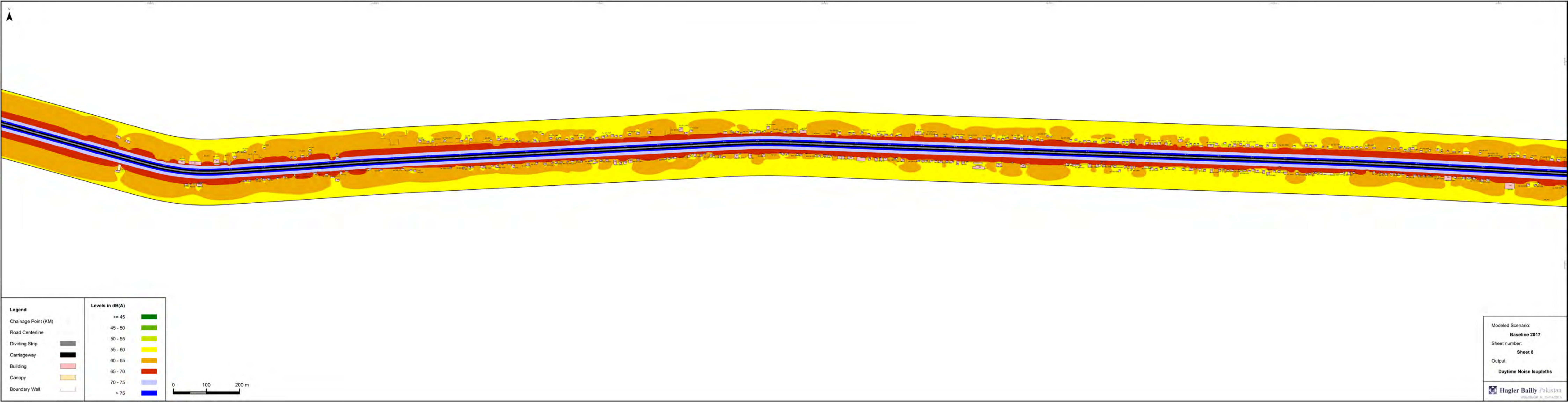
Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
Building
Canopy
Boundary Wall
Levels in dB(A)
<= 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
> 75
N
0
100
200 m
Modeled Scenario:
Baseline 2017
Sheet number:
Sheet 6
Output:
Daytime Noise Isopleths
Hagler Bailly Pakistan



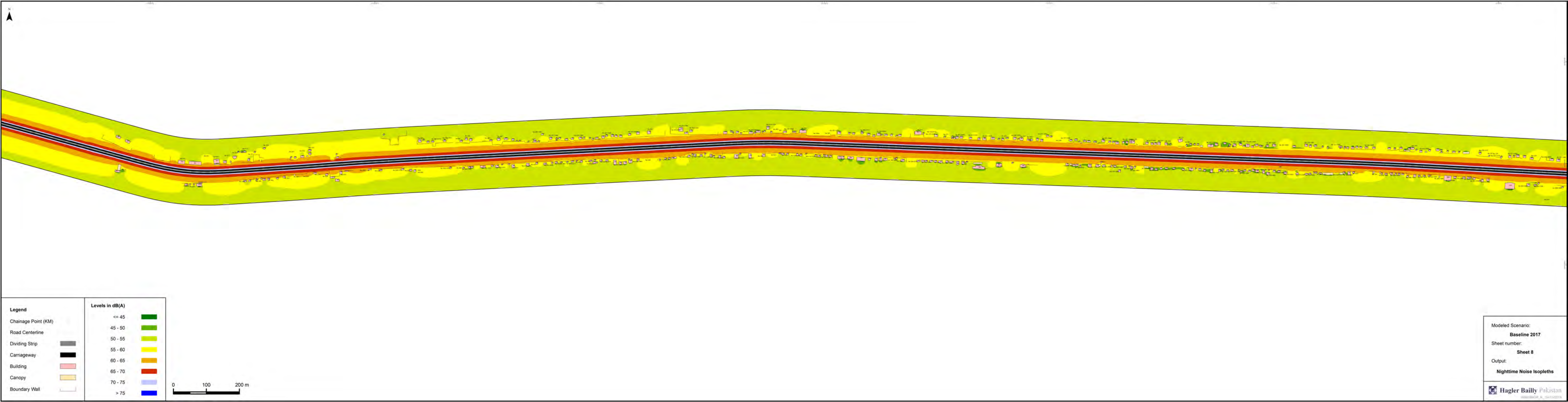
Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
Building
Canopy
Boundary Wall
Levels in dB(A)
<= 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
> 75
0
100
200 m
Modeled Scenario:
Baseline 2017
Sheet number:
Sheet 6
Output:
Nighttime Noise Isopleths
Hagler Bailly Pakistan


Modeled Scenario:
Baseline 2017
Sheet number:
Sheet 7
Output:
Daytime Noise Isopleths
Hagler Bailly Pakistan
Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
Building
Canopy
Boundary Wall
Levels in dB(A)
<= 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
> 75
0
100
200 m

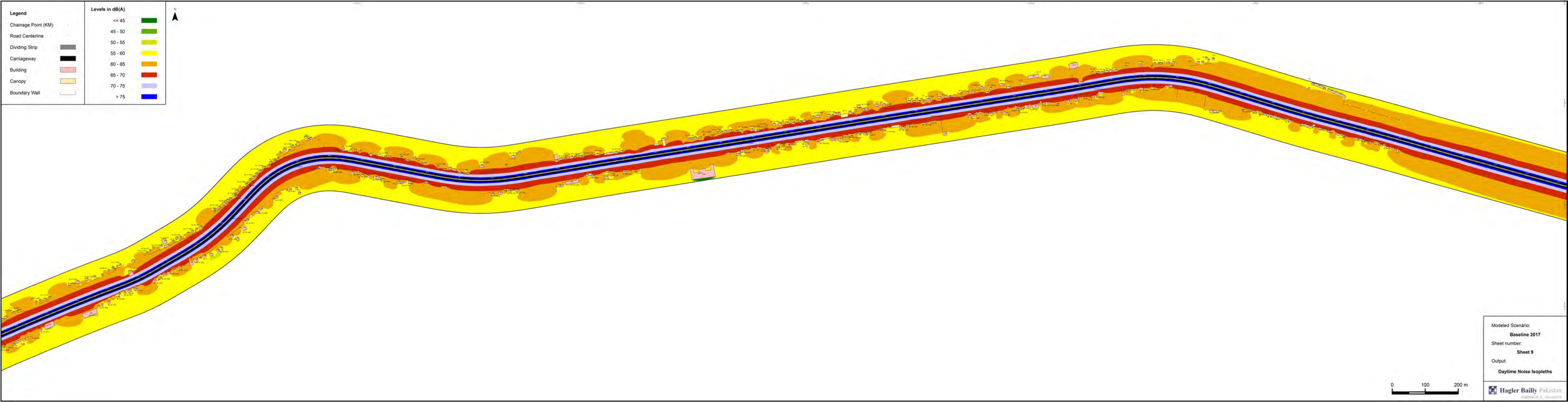

N
Modeled Scenario:
Baseline 2017
Sheet number:
Sheet 7
Output:
Nighttime Noise Isopleths
Hagler Bailly Pakistan
Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
Building
Canopy
Boundary Wall
Levels in dB(A)
<= 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
> 75
0
100
200 m

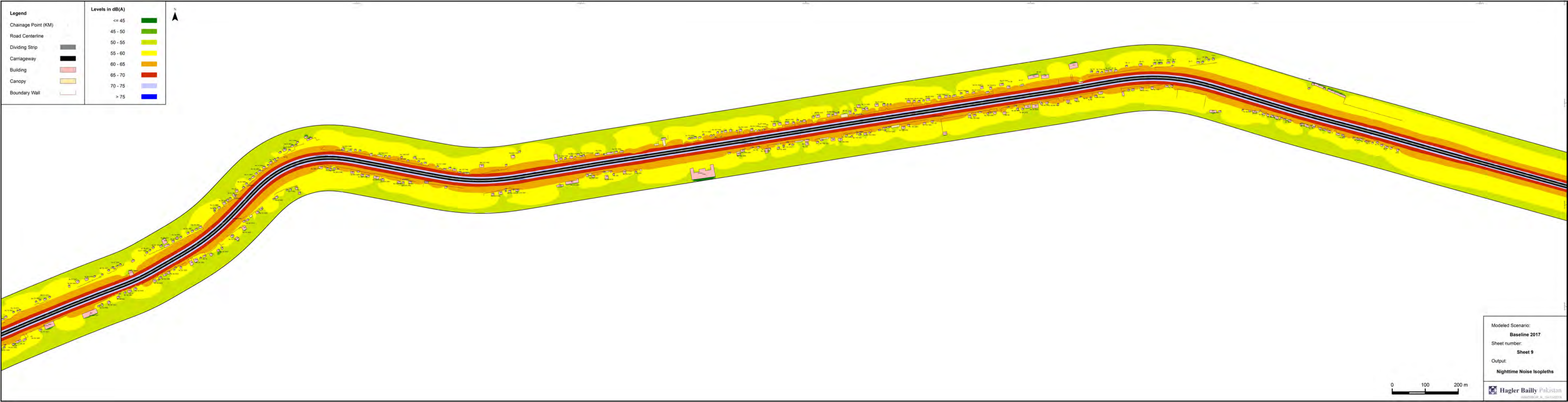


Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
Building
Canopy
Boundary Wall
Levels in dB(A)
<= 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
> 75
0
100
200 m
Modeled Scenario:
Baseline 2017
Sheet number:
Sheet 8
Output:
Daytime Noise Isopleths
Hagler Bailly Pakistan

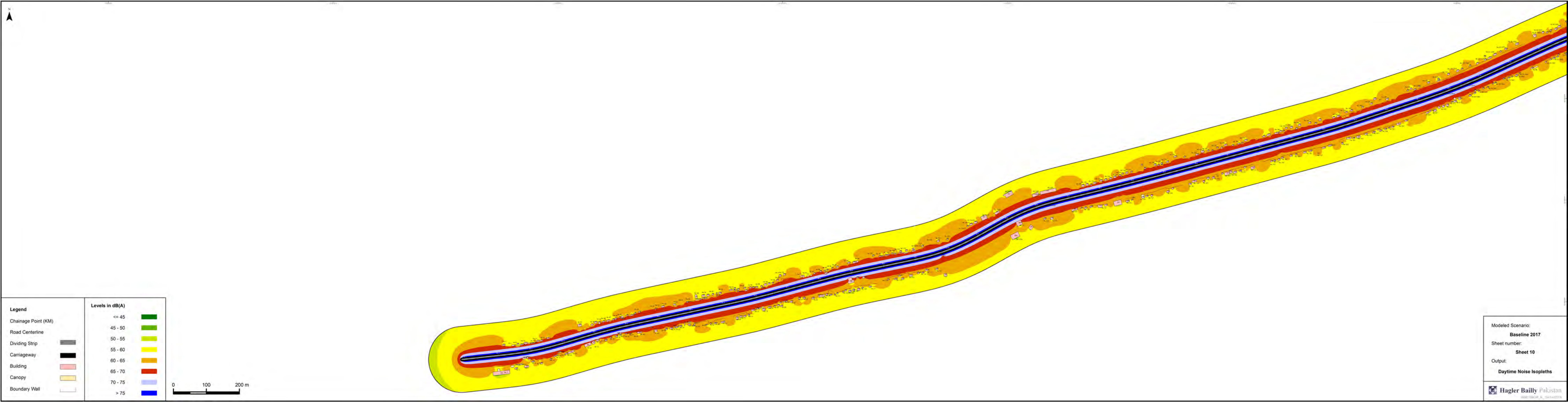


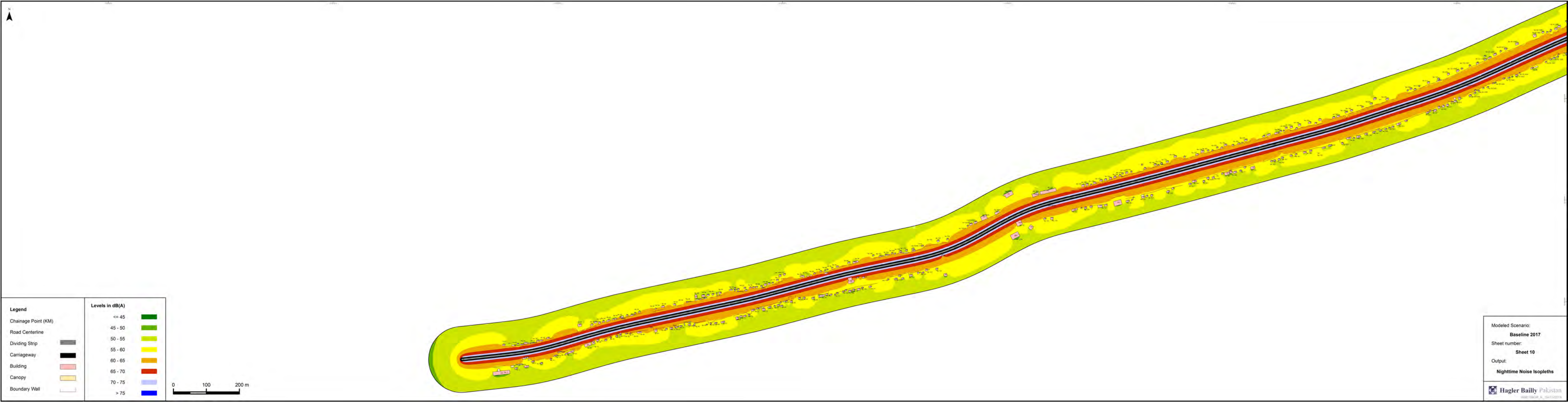
Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
Building
Canopy
Boundary Wall
Levels in dB(A)
<= 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
> 75
0
100
200 m
Modeled Scenario:
Baseline 2017
Sheet number:
Sheet 8
Output:
Nighttime Noise Isopleths
Hagler Bailly Pakistan


Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
Building
Canopy
Boundary Wall
Levels in dB(A)
<= 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
> 75
N
0
100
200 m
Modeled Scenario:
Baseline 2017
Sheet number:
Sheet 9
Output:
Daytime Noise Isopleths
Hagler Bailly Pakistan



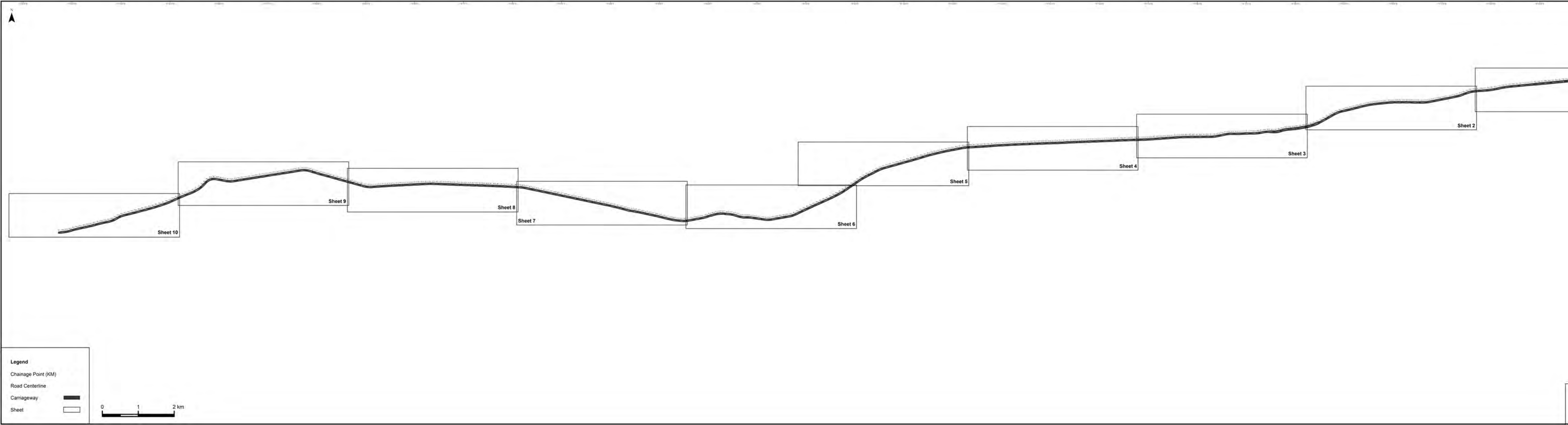
Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
Building
Canopy
Boundary Wall
Levels in dB(A)
<= 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
> 75
N
0
100
200 m
Modeled Scenario:
Baseline 2017
Sheet number:
Sheet 9
Output:
Nighttime Noise Isopleths
Hagler Bailly Pakistan


Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
Building
Canopy
Boundary Wall
Levels in dB(A)
<= 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
> 75
0
100
200 m
Modeled Scenario:
Baseline 2017
Sheet number:
Sheet 10
Output:
Daytime Noise Isopleths
Hagler Bailly Pakistan


Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
Building
Canopy
Boundary Wall
Levels in dB(A)
<= 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
> 75
0
100
200 m
Modeled Scenario:
Baseline 2017
Sheet number:
Sheet 10
Output:
Nighttime Noise Isopleths
Hagler Bailly Pakistan

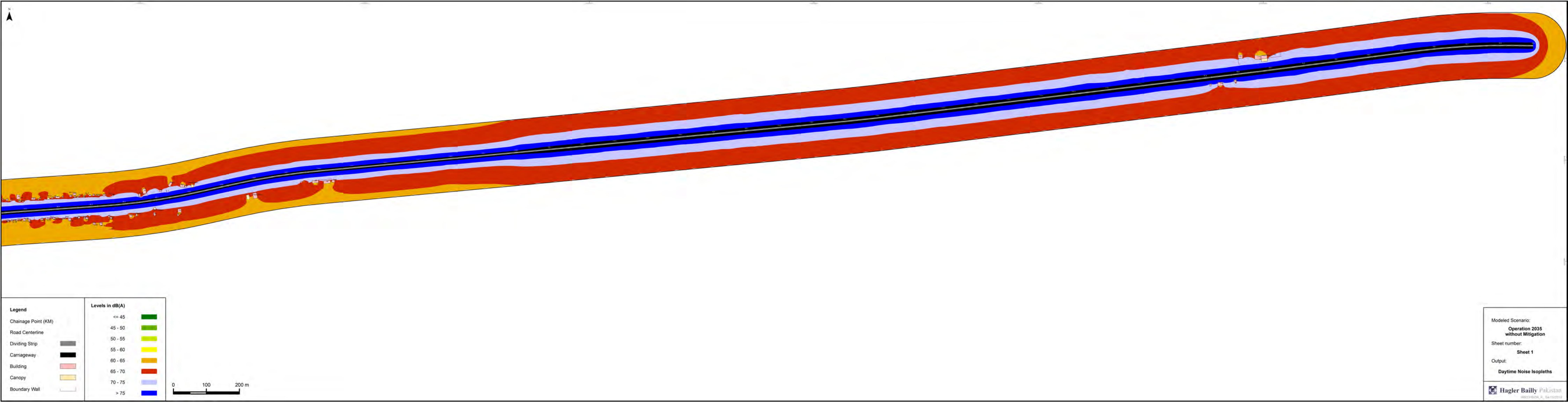
ANNEXURE II: OPERATION OUTPUTS – UNMITIGATED

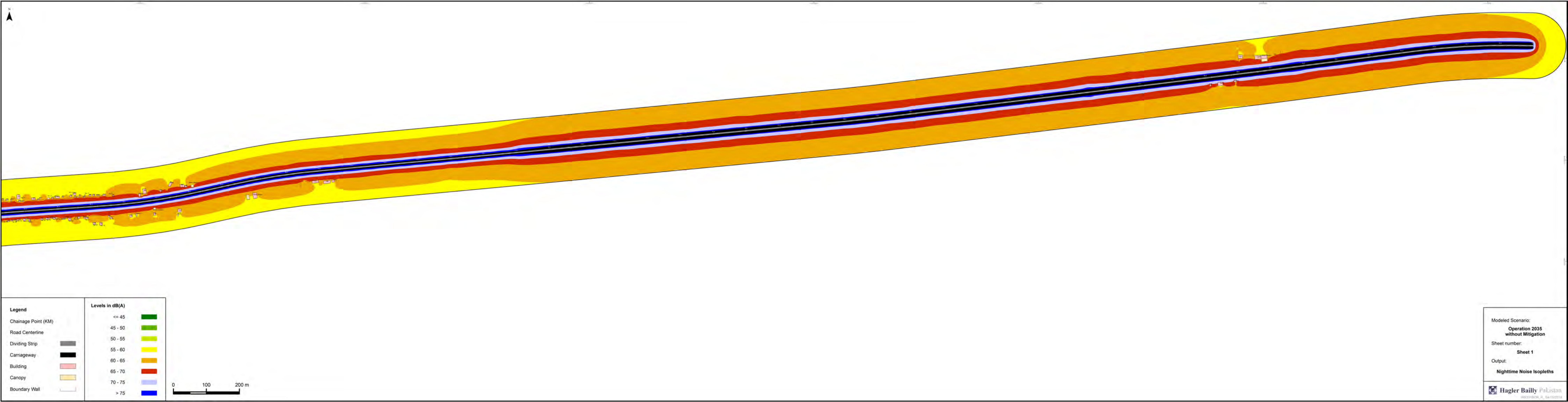
1. See following pages.



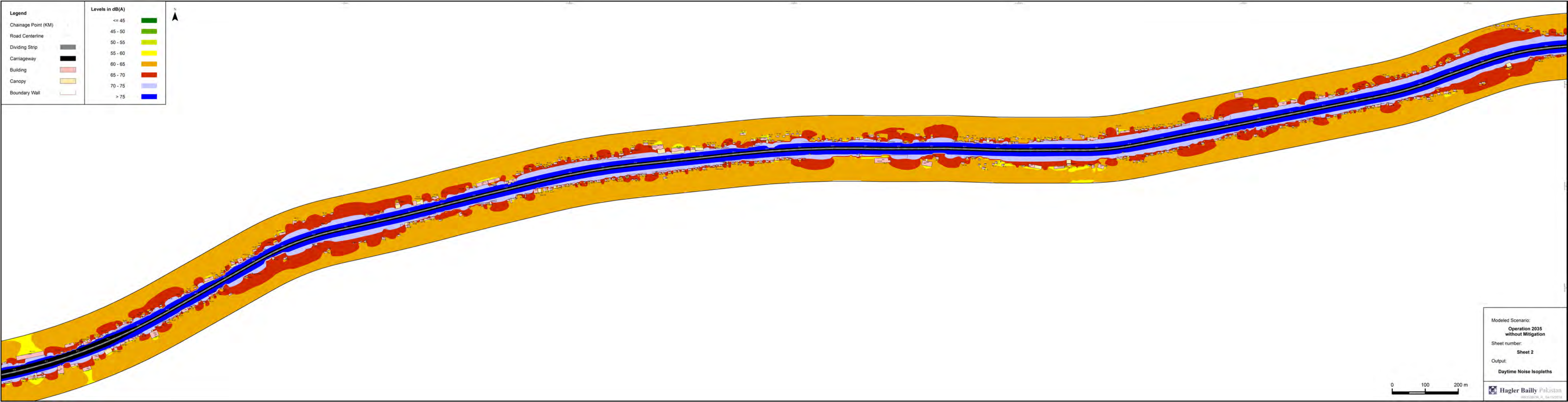
Index Map

Hagler Bailly Pakistan

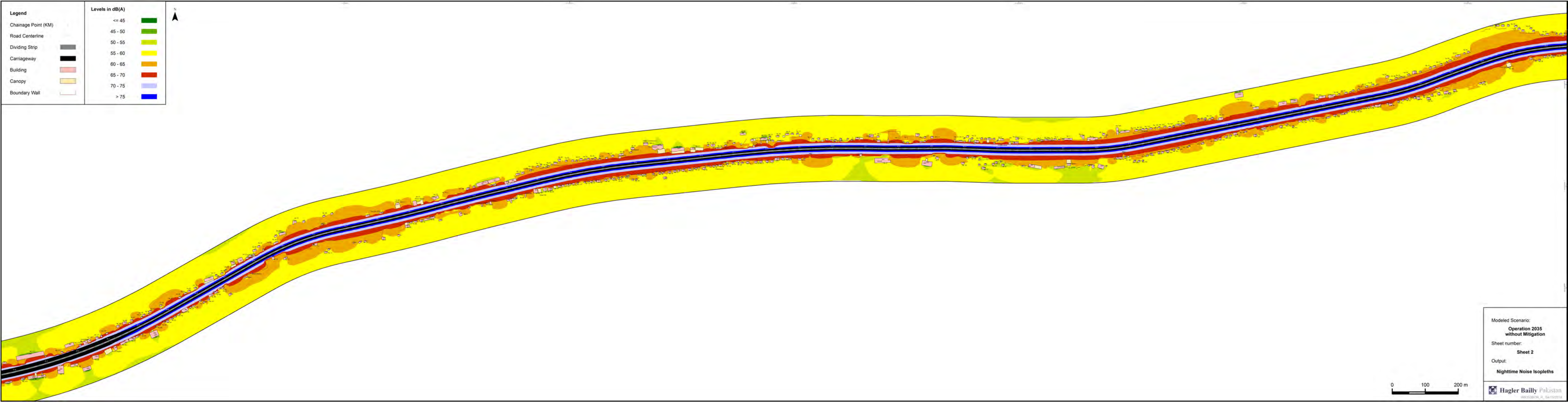

Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
Building
Canopy
Boundary Wall
Levels in dB(A)
<= 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
> 75
0
100
200 m
Modeled Scenario:
Operation 2035
without Mitigation
Sheet number:
Sheet 1
Output:
Daytime Noise Isopleths
Hagler Bailly Pakistan

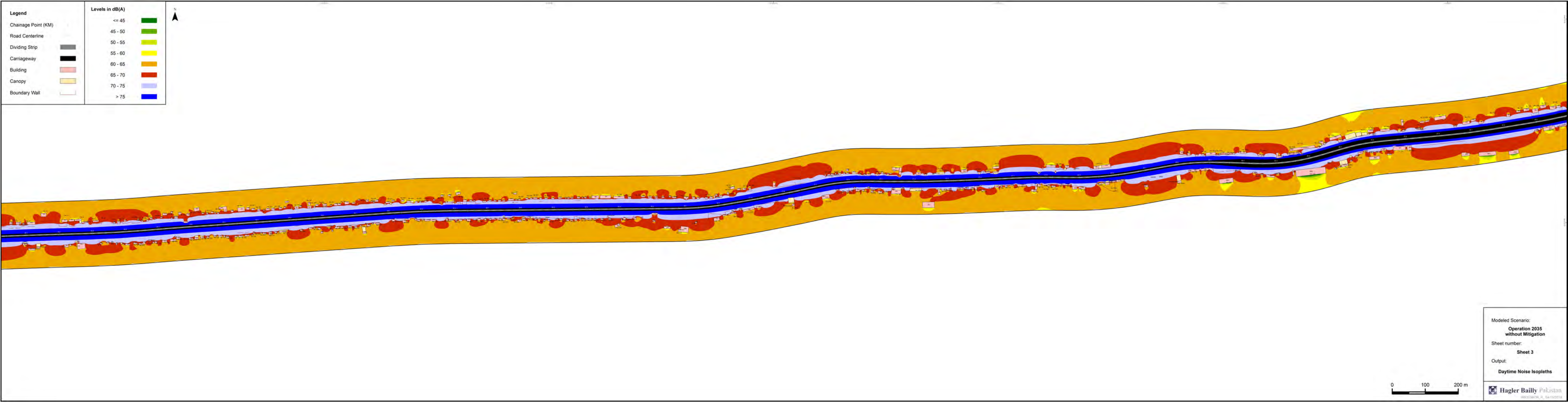


Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
Building
Canopy
Boundary Wall
Levels in dB(A)
<= 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
> 75
0
100
200 m
Modeled Scenario:
Operation 2035
without Mitigation
Sheet number:
Sheet 1
Output:
Nighttime Noise Isopleths
Hagler Bailly Pakistan

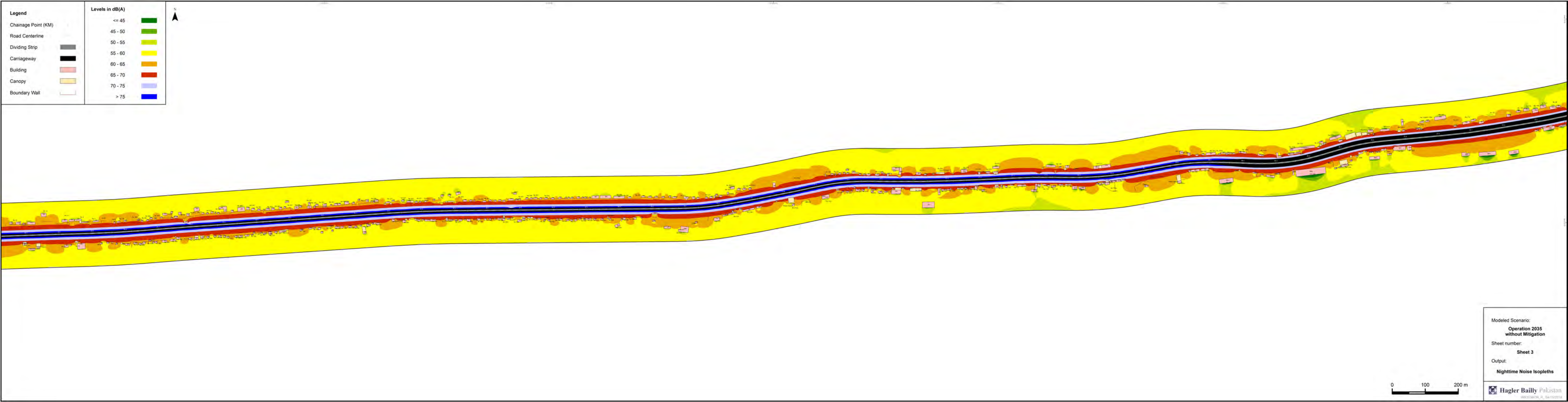


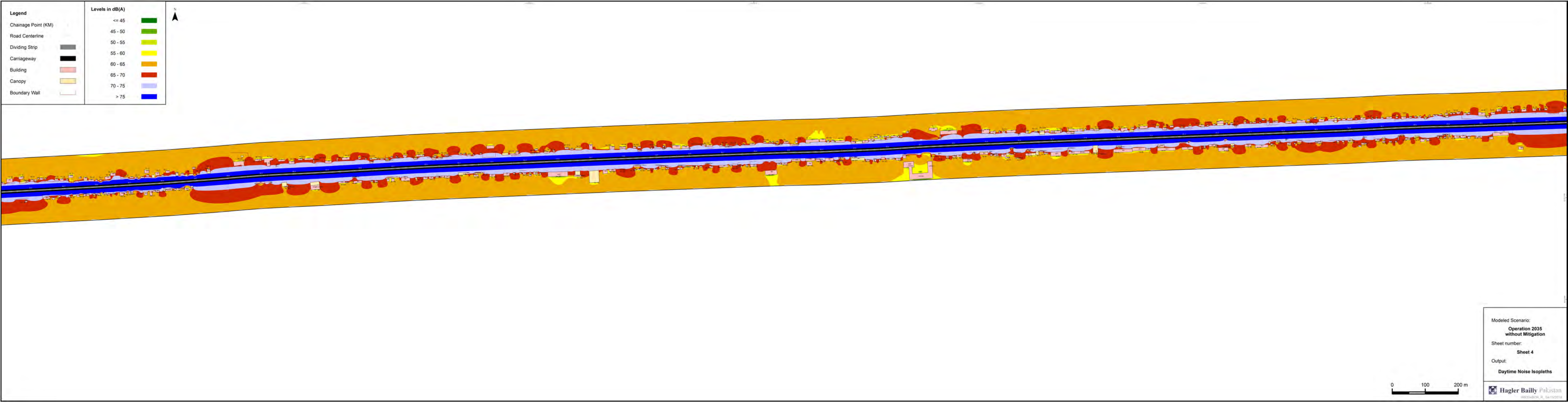
Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
Building
Canopy
Boundary Wall
Levels in dB(A)
<= 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
> 75
0
100
200 m
Modeled Scenario:
Operation 2035
without Mitigation
Sheet number:
Sheet 2
Output:
Daytime Noise Isopleths
Hagler Bailly Pakistan


Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
Building
Canopy
Boundary Wall
Levels in dB(A)
<= 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
> 75
N
Modeled Scenario:
Operation 2035
without Mitigation
Sheet number:
Sheet 2
Output:
Nighttime Noise Isopleths
0
100
200 m
Hagler Bailly Pakistan



Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
Building
Canopy
Boundary Wall
Levels in dB(A)
<= 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
> 75
0
100
200 m
Modeled Scenario:
Operation 2035
without Mitigation
Sheet number:
Sheet 3
Output:
Daytime Noise Isopleths
Hagler Bailly Pakistan


Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
Building
Canopy
Boundary Wall
Levels in dB(A)
<= 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
> 75
0
100
200 m
Modeled Scenario:
Operation 2035
without Mitigation
Sheet number:
Sheet 3
Output:
Nighttime Noise Isopleths
Hagler Bailly Pakistan



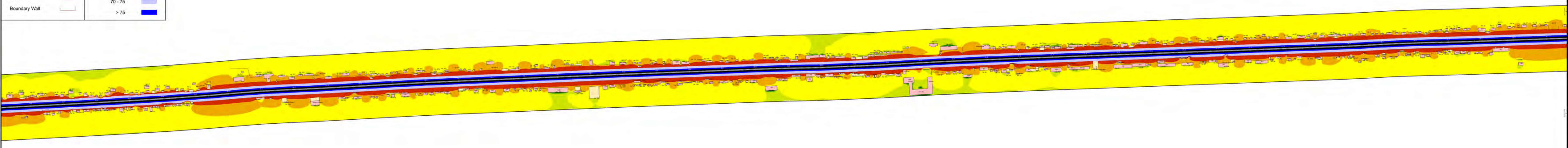
Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
Building
Canopy
Boundary Wall
Levels in dB(A)
<= 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
> 75
0
100
200 m
Modeled Scenario:
Operation 2035
without Mitigation
Sheet number:
Sheet 4
Output:
Daytime Noise Isopleths
Hagler Bailly Pakistan

Legend

Chainage Point (KM)	
Road Centerline	
Dividing Strip	
Carriageway	
Building	
Canopy	
Boundary Wall	

Levels in dB(A)

<= 45	
45 - 50	
50 - 55	
55 - 60	
60 - 65	
65 - 70	
70 - 75	
> 75	



0 100 200 m

Modeled Scenario:

Operation 2035 without Mitigation

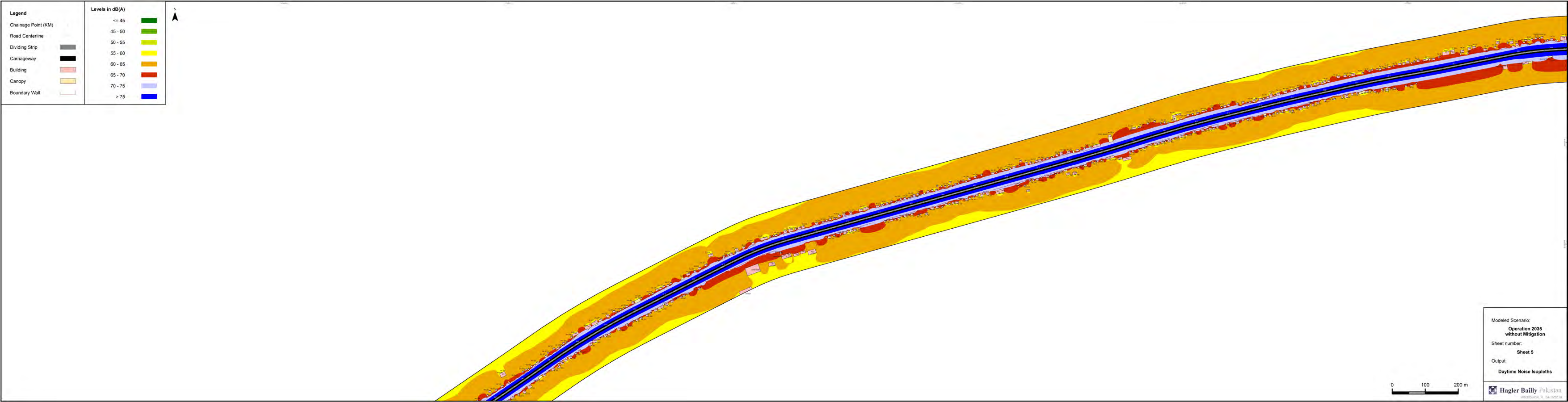
Sheet number:

Sheet 4

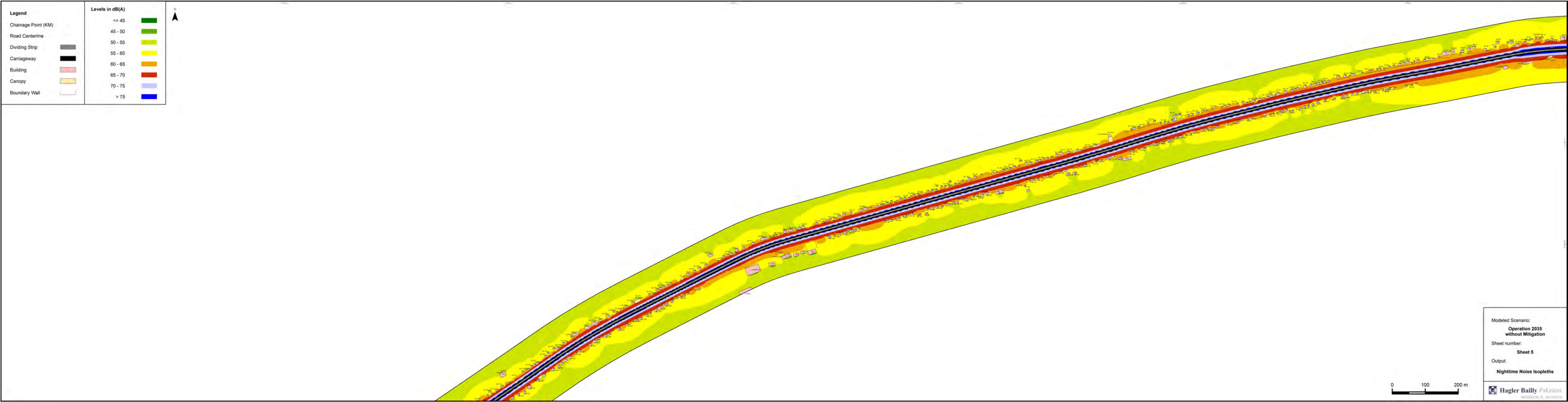
Output:

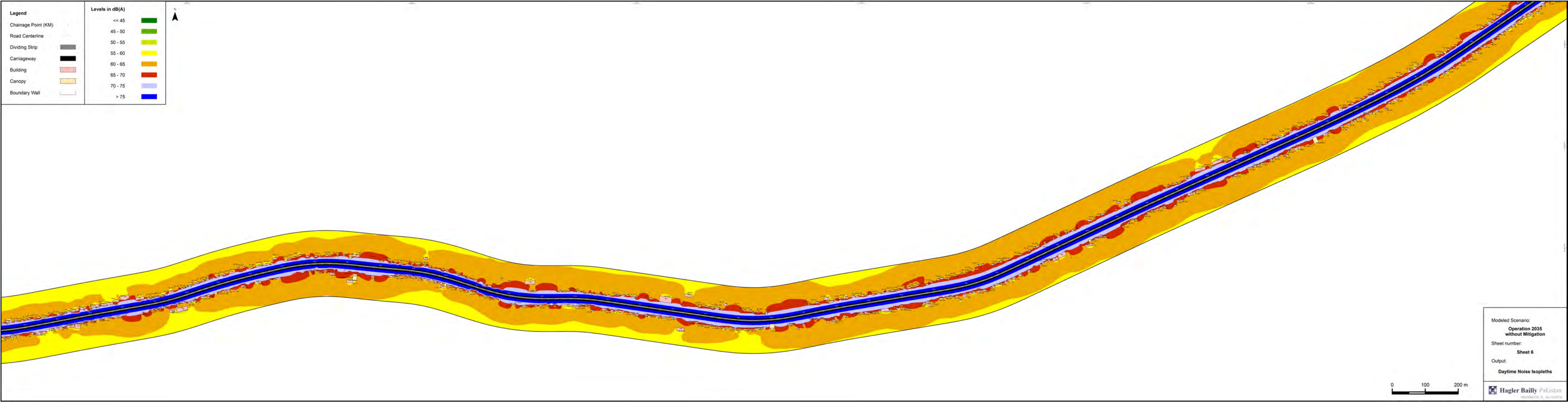
Nighttime Noise Isopleths

Hagler Bailly Pakistan

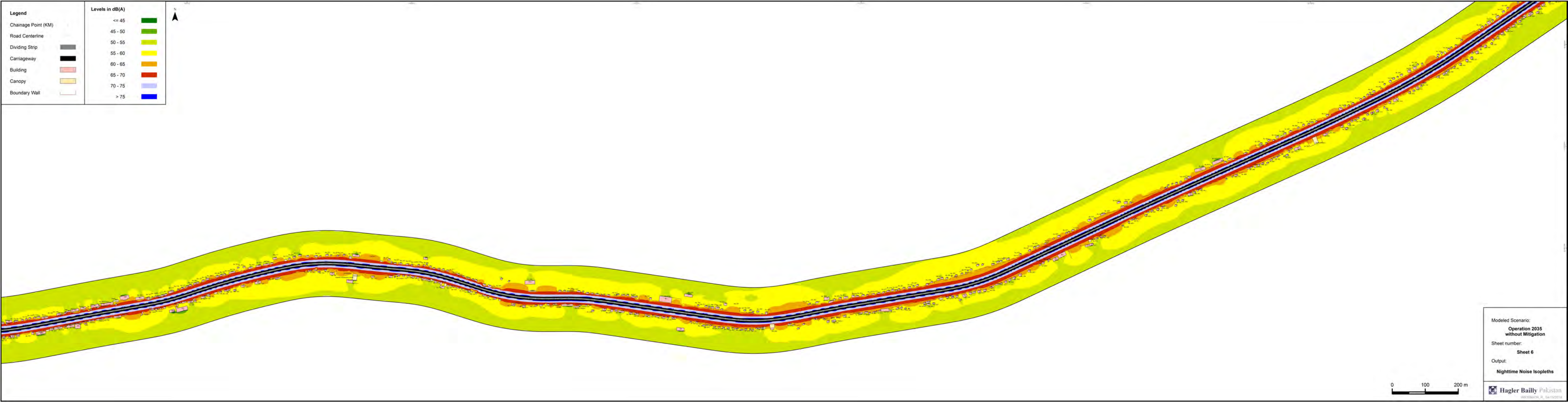


Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
Building
Canopy
Boundary Wall
Levels in dB(A)
<= 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
> 75
0
100
200 m
Modeled Scenario:
Operation 2035
without Mitigation
Sheet number:
Sheet 5
Output:
Daytime Noise Isopleths
Hagler Bailly Pakistan

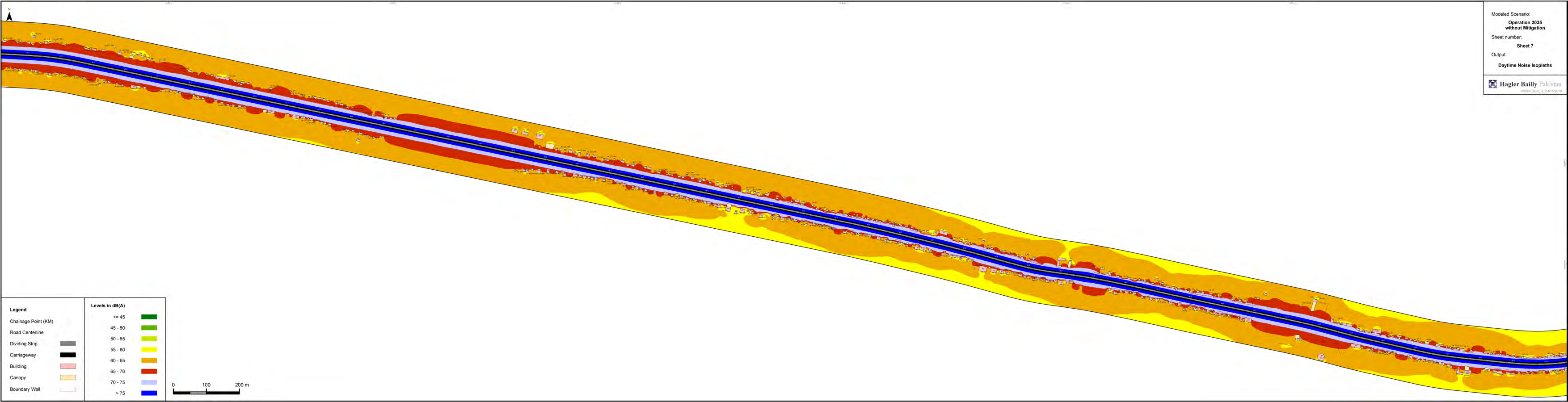

Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
Building
Canopy
Boundary Wall
Levels in dB(A)
<= 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
> 75
0
100
200 m
Modeled Scenario:
Operation 2035
without Mitigation
Sheet number:
Sheet 5
Output:
Nighttime Noise Isopleths
Hagler Bailly Pakistan

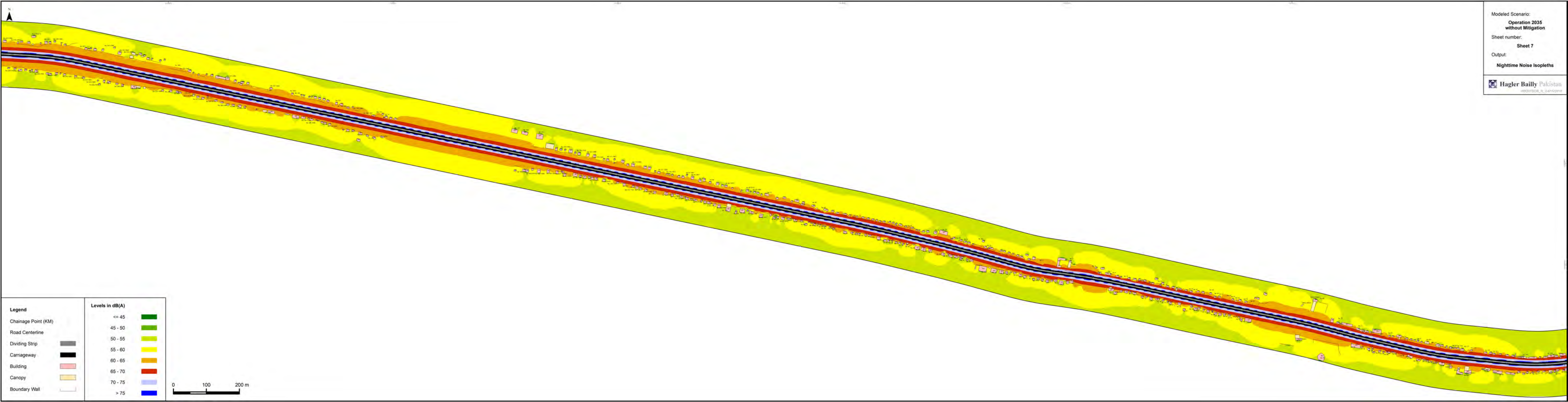


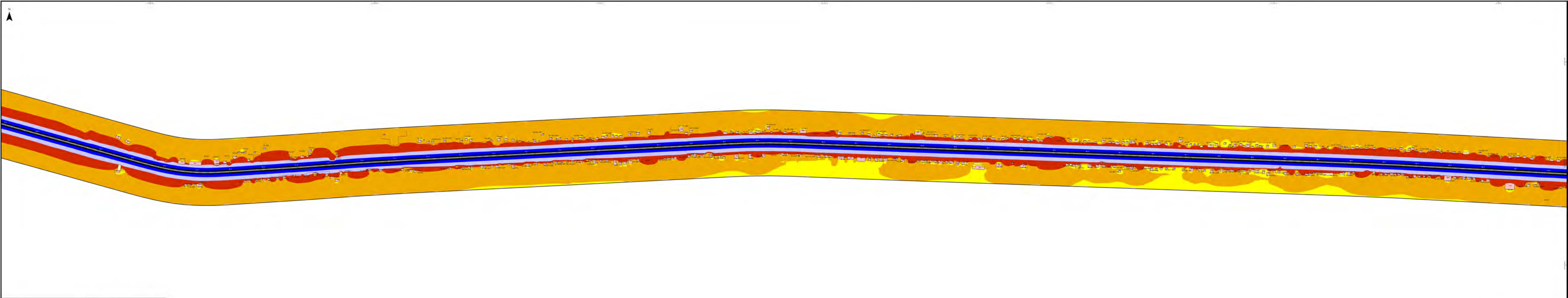
Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
Building
Canopy
Boundary Wall
Levels in dB(A)
<= 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
> 75
0
100
200 m
Modeled Scenario:
Operation 2035
without Mitigation
Sheet number:
Sheet 6
Output:
Daytime Noise Isopleths
Hagler Bailly Pakistan



Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
Building
Canopy
Boundary Wall
Levels in dB(A)
<= 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
> 75
0
100
200 m
Modeled Scenario:
Operation 2035
without Mitigation
Sheet number:
Sheet 6
Output:
Nighttime Noise Isopleths
Hagler Bailly Pakistan


Modeled Scenario:
Operation 2035 without Mitigation
Sheet number:
Sheet 7
Output:
Daytime Noise Isopleths
Hagler Bailly Pakistan
Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
Building
Canopy
Boundary Wall
Levels in dB(A)
<= 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
> 75
0
100
200 m


Modeled Scenario:
Operation 2035 without Mitigation
Sheet number:
Sheet 7
Output:
Nighttime Noise Isopleths
Hagler Bailly Pakistan
Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
Building
Canopy
Boundary Wall
Levels in dB(A)
<= 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
> 75
0
100
200 m



Legend

- Chainage Point (KM)
- Road Centerline
- Dividing Strip
- Carriageway
- Building
- Canopy
- Boundary Wall

Levels in dB(A)

- <= 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- 65 - 70
- 70 - 75
- > 75

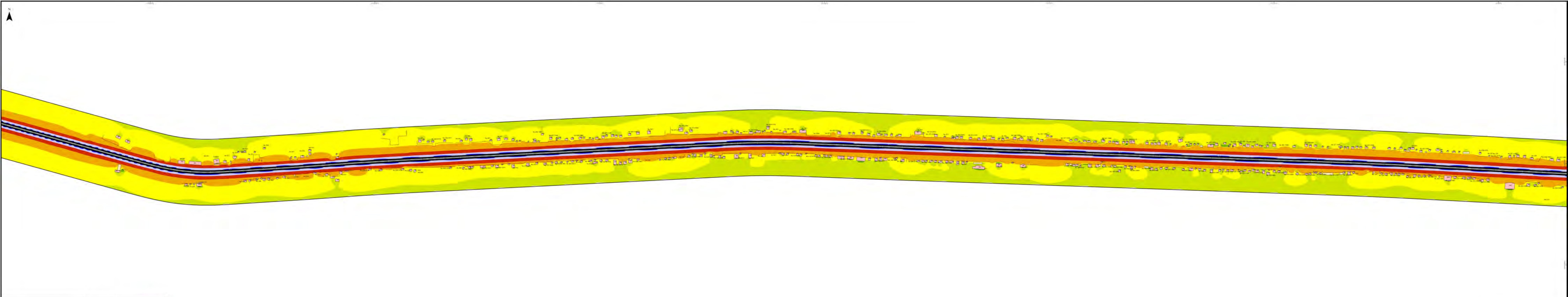
0 100 200 m

Modeled Scenario:
Operation 2035 without Mitigation

Sheet number:
Sheet 8

Output:
Daytime Noise Isopleths

Hagler Bailly Pakistan



Legend

Chainage Point (KM)

Road Centerline

Dividing Strip

Carriageway

Building

Canopy

Boundary Wall

Levels in dB(A)

<= 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
> 75

0 100 200 m

Modeled Scenario:

Operation 2035 without Mitigation

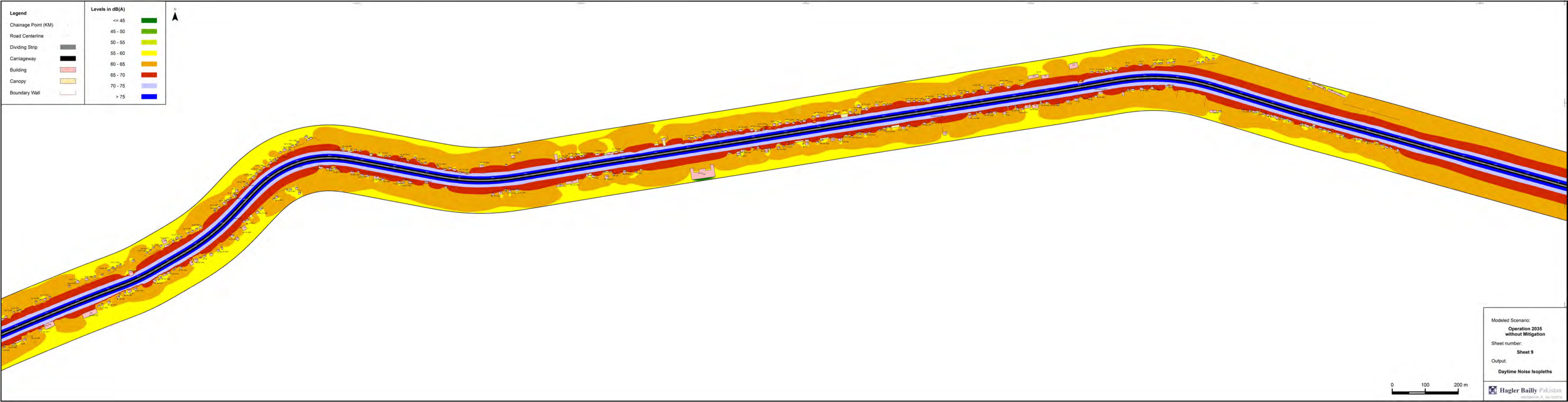
Sheet number:

Sheet 8

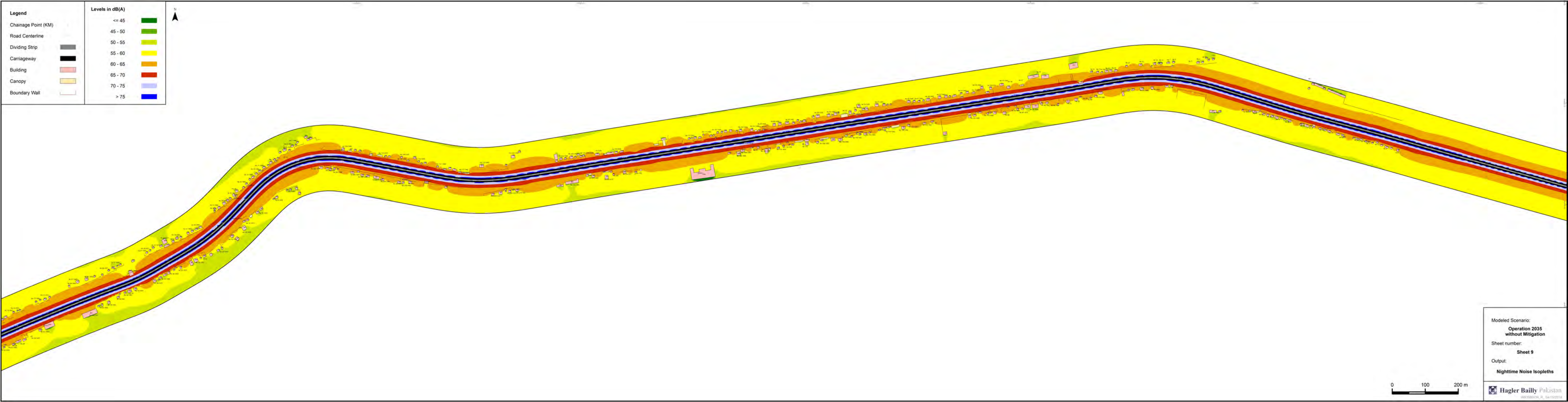
Output:

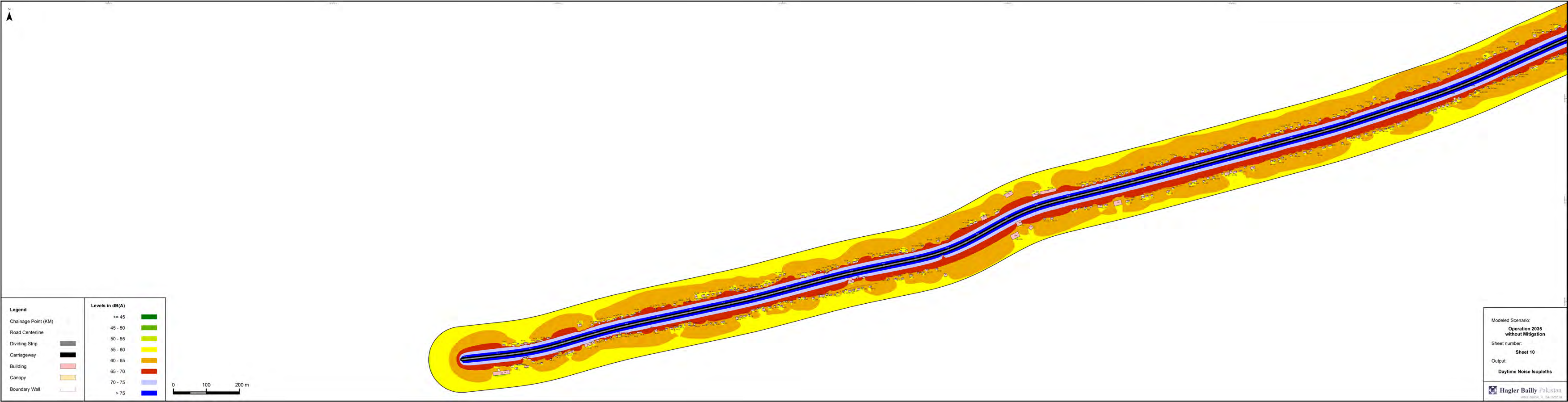
Nighttime Noise Isopleths

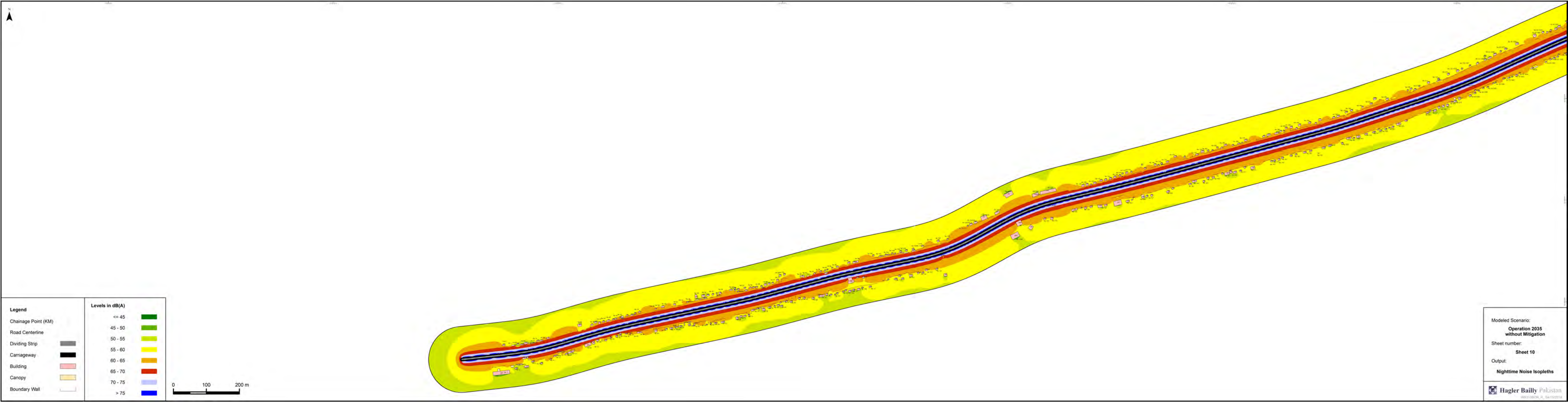
Hagler Bailly Pakistan



Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
Building
Canopy
Boundary Wall
Levels in dB(A)
<= 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
> 75
N
0
100
200 m
Modeled Scenario:
Operation 2035
without Mitigation
Sheet number:
Sheet 9
Output:
Daytime Noise Isopleths
Hagler Bailly Pakistan

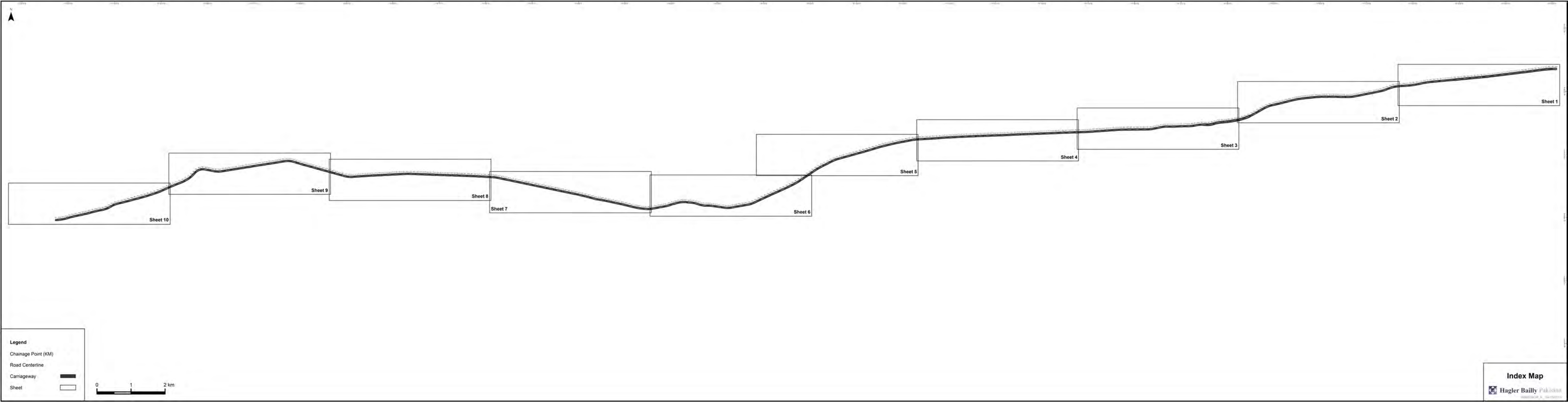

Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
Building
Canopy
Boundary Wall
Levels in dB(A)
<= 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
> 75
N
0
100
200 m
Modeled Scenario:
Operation 2035
without Mitigation
Sheet number:
Sheet 9
Output:
Nighttime Noise Isopleths
Hagler Bailly Pakistan


Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
Building
Canopy
Boundary Wall
Levels in dB(A)
<= 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
> 75
0
100
200 m
Modeled Scenario:
Operation 2035
without Mitigation
Sheet number:
Sheet 10
Output:
Daytime Noise Isopleths
Hagler Bailly Pakistan

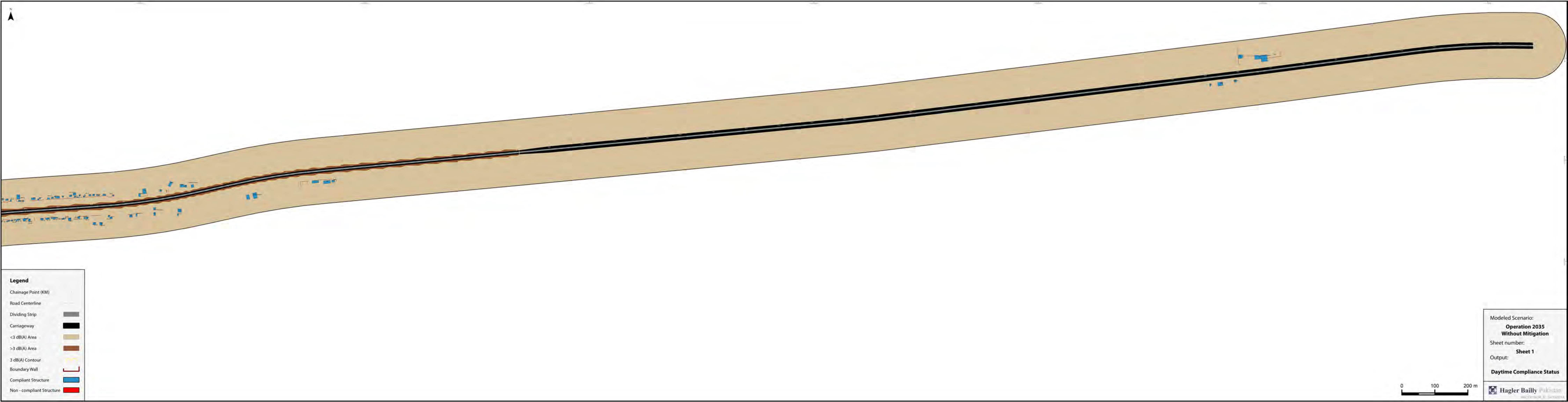

Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
Building
Canopy
Boundary Wall
Levels in dB(A)
<= 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
> 75
0
100
200 m
Modeled Scenario:
Operation 2035 without Mitigation
Sheet number:
Sheet 10
Output:
Nighttime Noise Isopleths
Hagler Bailly Pakistan

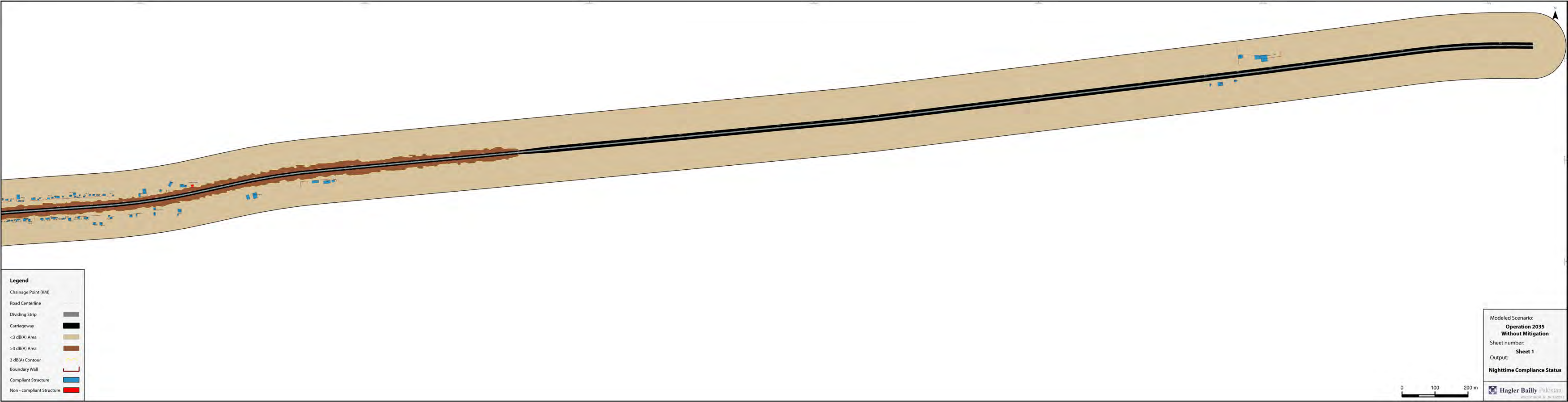
ANNEXURE III: OPERATION OUTPUTS – UNMITIGATED (COMPLIANCE STATUS WITH IFC)

1. See following pages.

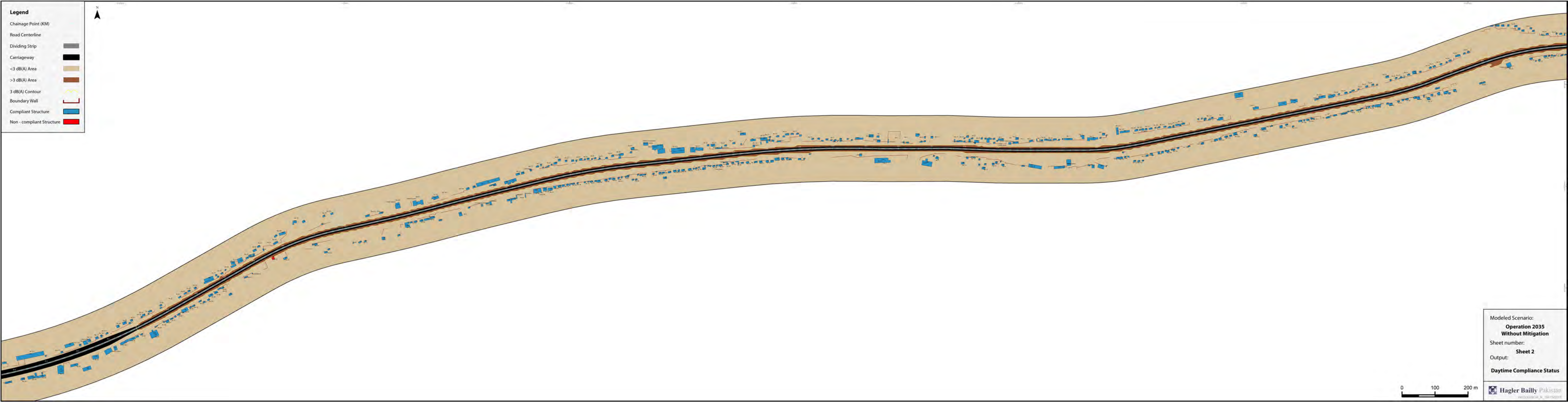


Sheet 1
Sheet 2
Sheet 3
Sheet 4
Sheet 5
Sheet 6
Sheet 7
Sheet 8
Sheet 9
Sheet 10
Legend
Chainage Point (KM)
Road Centerline
Carriageway
Sheet
0
1
2 km
Index Map
Hagler Bailly Pakistan

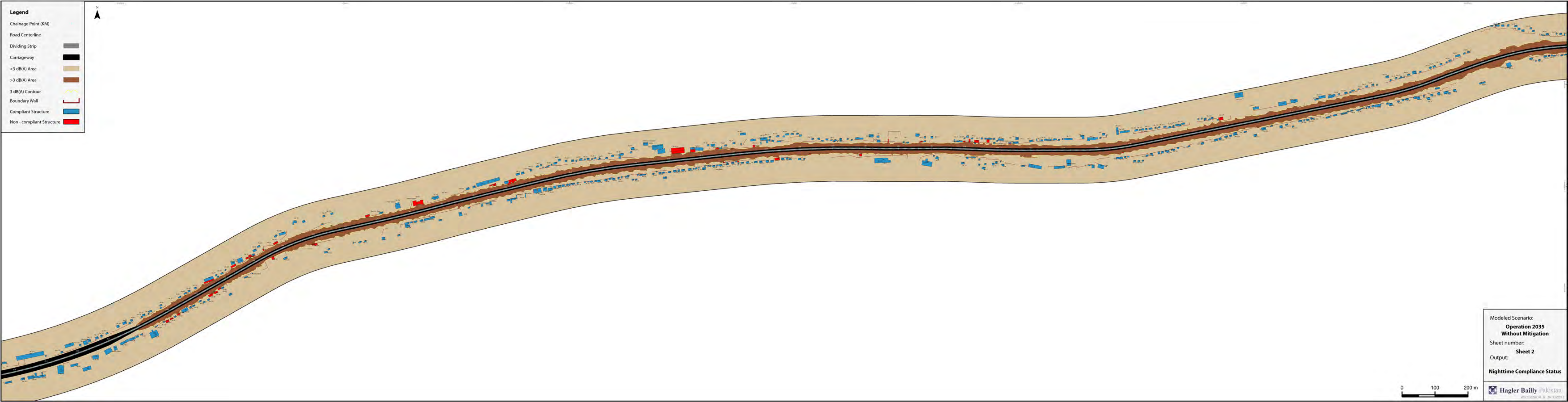

Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
<3 dB(A) Area
>3 dB(A) Area
3 dB(A) Contour
Boundary Wall
Compliant Structure
Non - compliant Structure
0
100
200 m
Modeled Scenario:
Operation 2035
Without Mitigation
Sheet number:
Sheet 1
Output:
Daytime Compliance Status
Hagler Bailly Pakistan

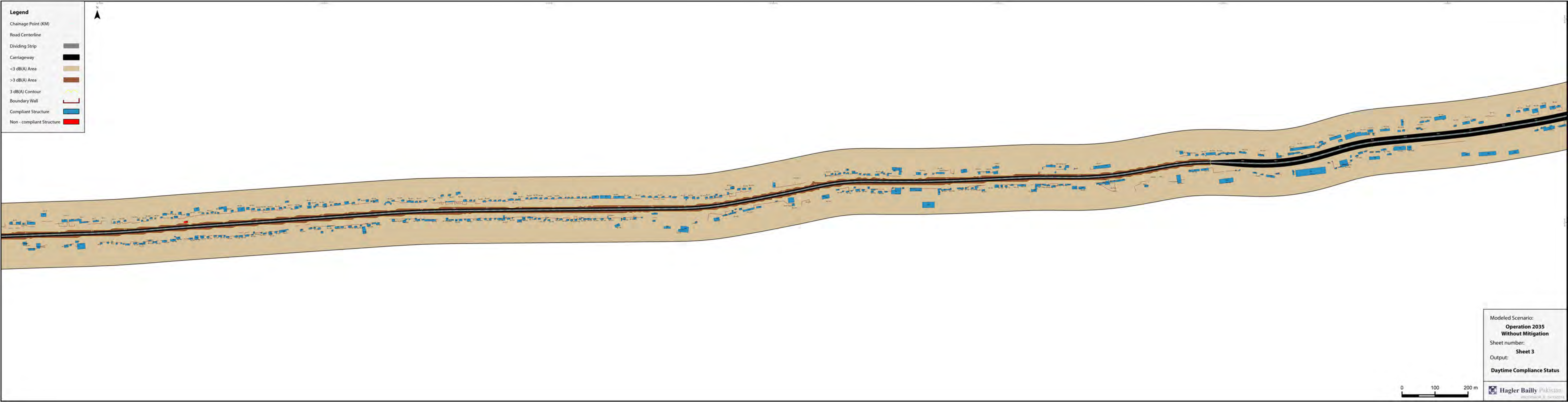


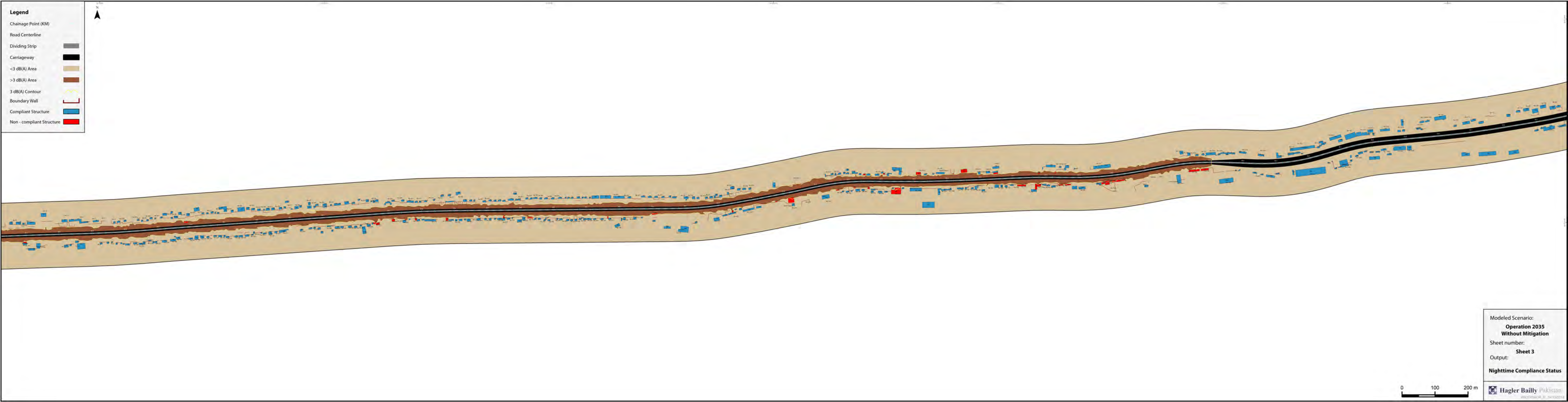
Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
<3 dB(A) Area
>3 dB(A) Area
3 dB(A) Contour
Boundary Wall
Compliant Structure
Non - compliant Structure
0
100
200 m
Modeled Scenario:
Operation 2035
Without Mitigation
Sheet number:
Sheet 1
Output:
Nighttime Compliance Status
Hagler Bailly Pakistan



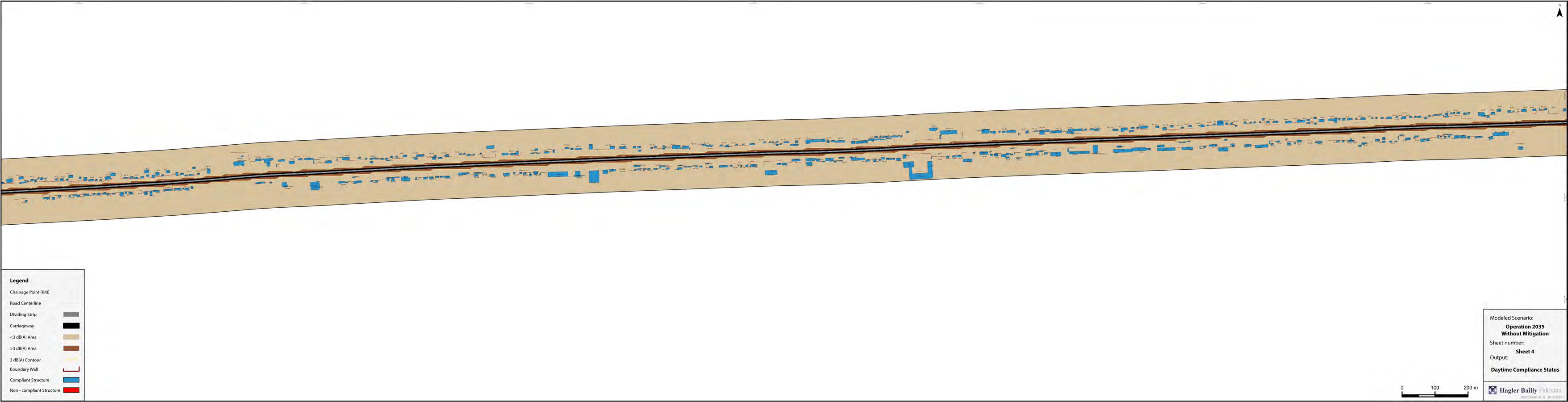
Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
<3 dB(A) Area
>3 dB(A) Area
3 dB(A) Contour
Boundary Wall
Compliant Structure
Non - compliant Structure
N
0
100
200 m
Modeled Scenario:
Operation 2035
Without Mitigation
Sheet number:
Sheet 2
Output:
Daytime Compliance Status
Hagler Bailly Pakistan

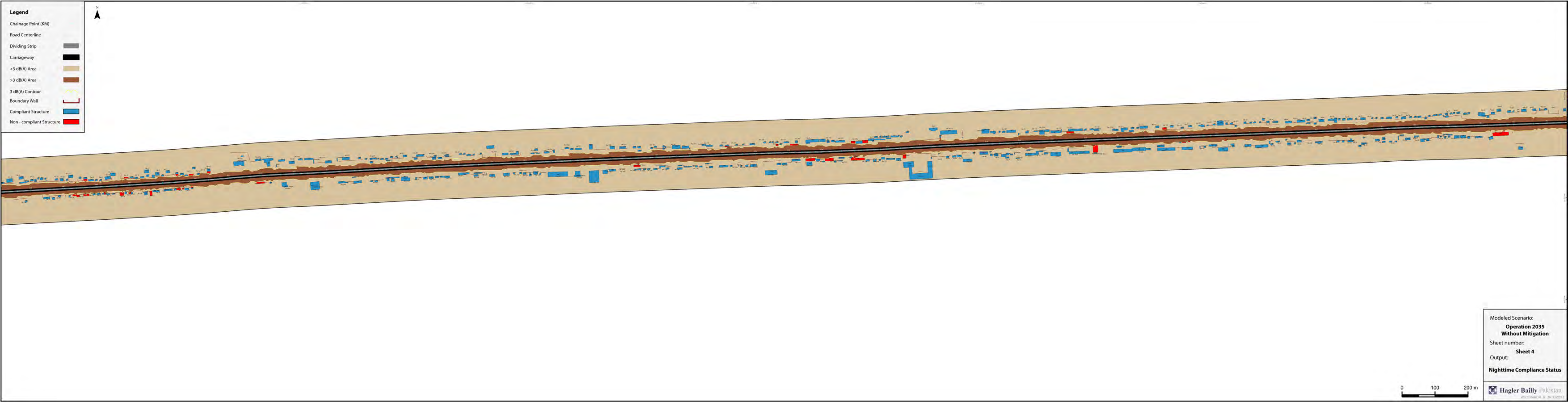

Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
<3 dB(A) Area
>3 dB(A) Area
3 dB(A) Contour
Boundary Wall
Compliant Structure
Non - compliant Structure
N
0
100
200 m
Modeled Scenario:
Operation 2035
Without Mitigation
Sheet number:
Sheet 2
Output:
Nighttime Compliance Status
Hagler Bailly Pakistan


Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
<3 dB(A) Area
>3 dB(A) Area
3 dB(A) Contour
Boundary Wall
Compliant Structure
Non - compliant Structure
0
100
200 m
Modeled Scenario:
Operation 2035
Without Mitigation
Sheet number:
Sheet 3
Output:
Daytime Compliance Status
Hagler Bailly Pakistan



Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
<3 dB(A) Area
>3 dB(A) Area
3 dB(A) Contour
Boundary Wall
Compliant Structure
Non - compliant Structure
0
100
200 m
Modeled Scenario:
Operation 2035
Without Mitigation
Sheet number:
Sheet 3
Output:
Nighttime Compliance Status
Hagler Bailly Pakistan


Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
<3 dB(A) Area
>3 dB(A) Area
3 dB(A) Contour
Boundary Wall
Compliant Structure
Non - compliant Structure
0
100
200 m
Modeled Scenario:
Operation 2035
Without Mitigation
Sheet number:
Sheet 4
Output:
Daytime Compliance Status
Hagler Bailly Pakistan



Modeled Scenario:

Operation 2035
Without Mitigation

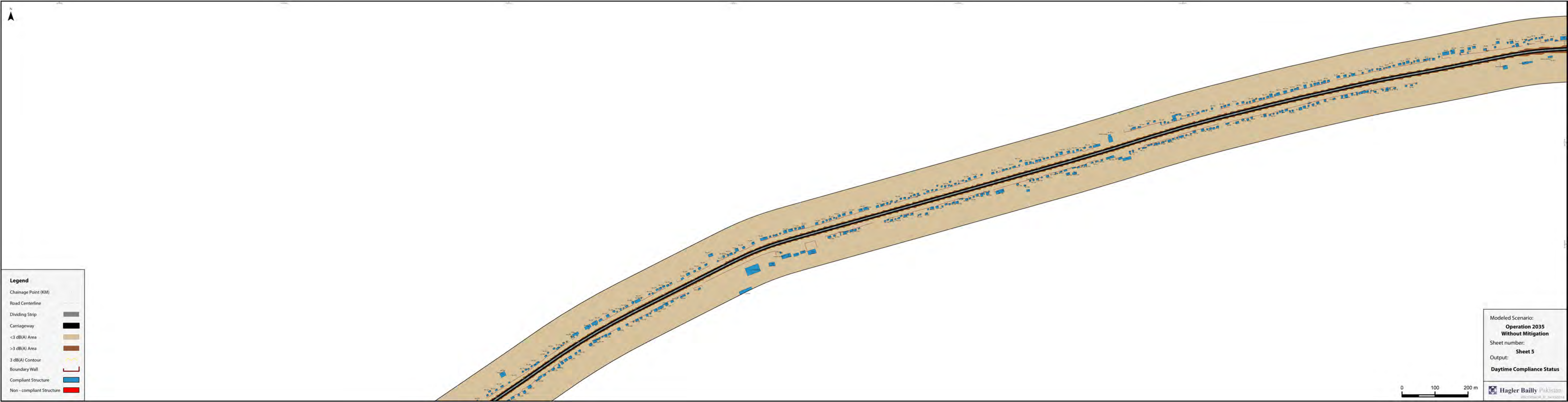
Sheet number:

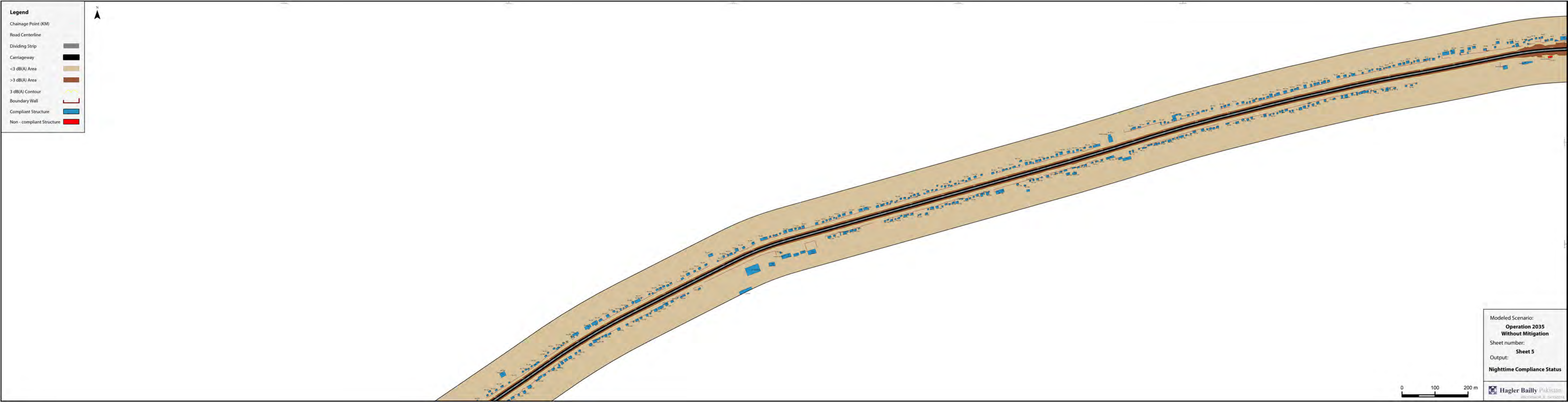
Sheet 4

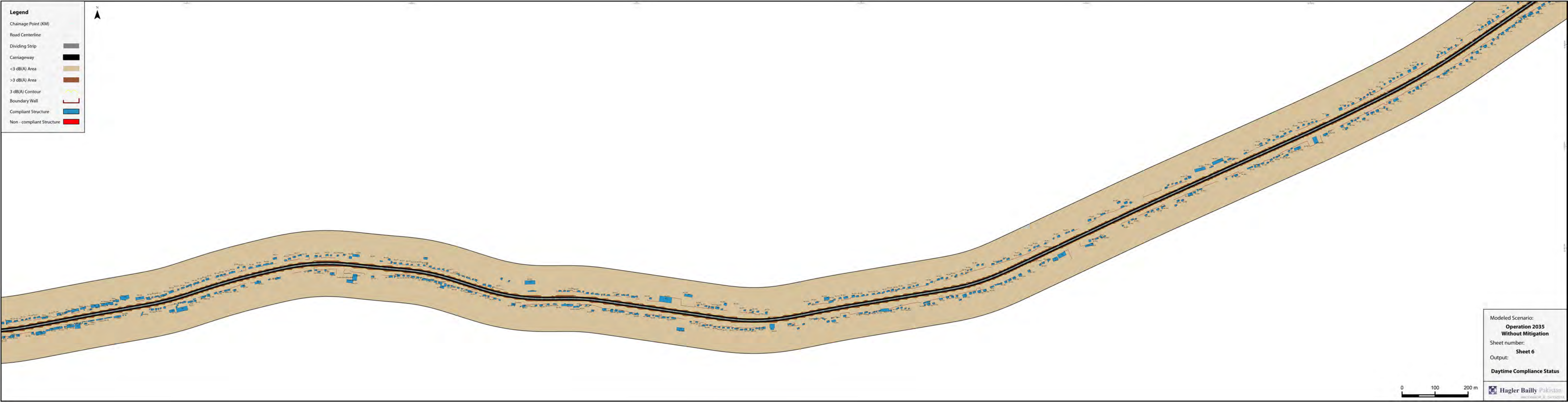
Output:

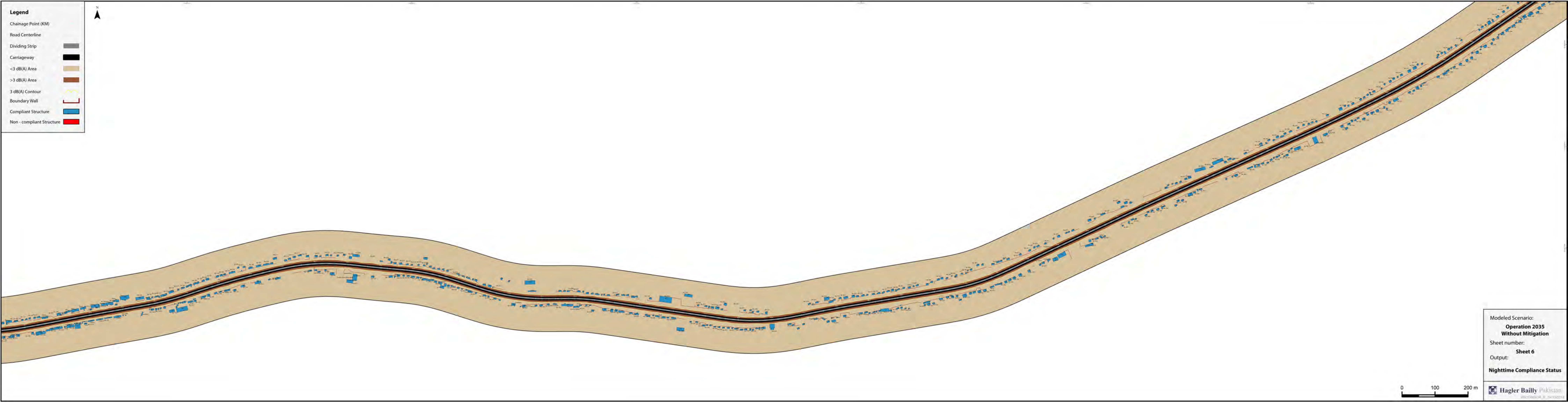
Nighttime Compliance Status

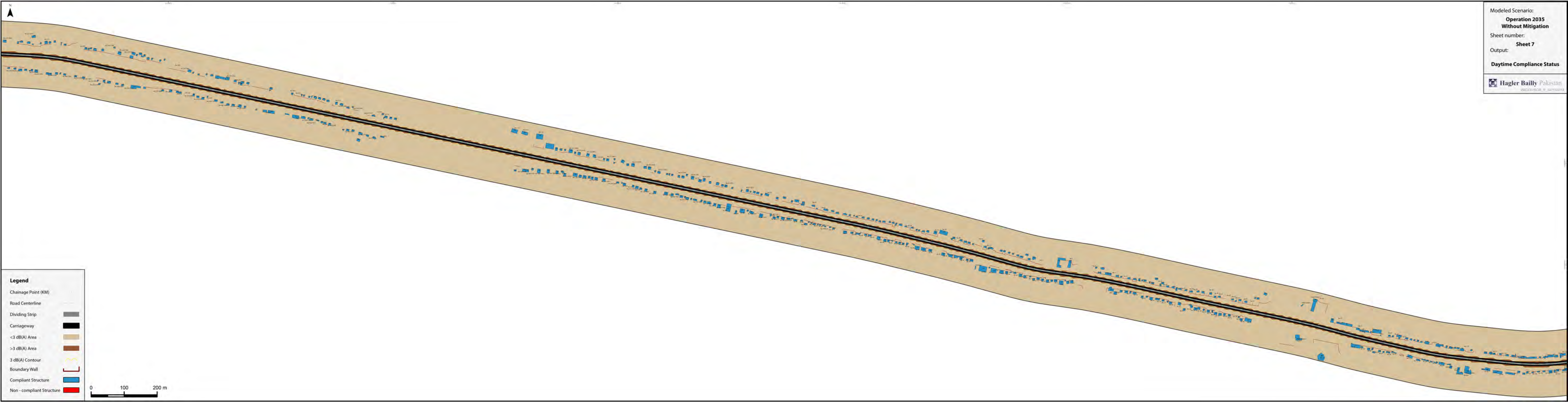
Hagler Bailly Pakistan

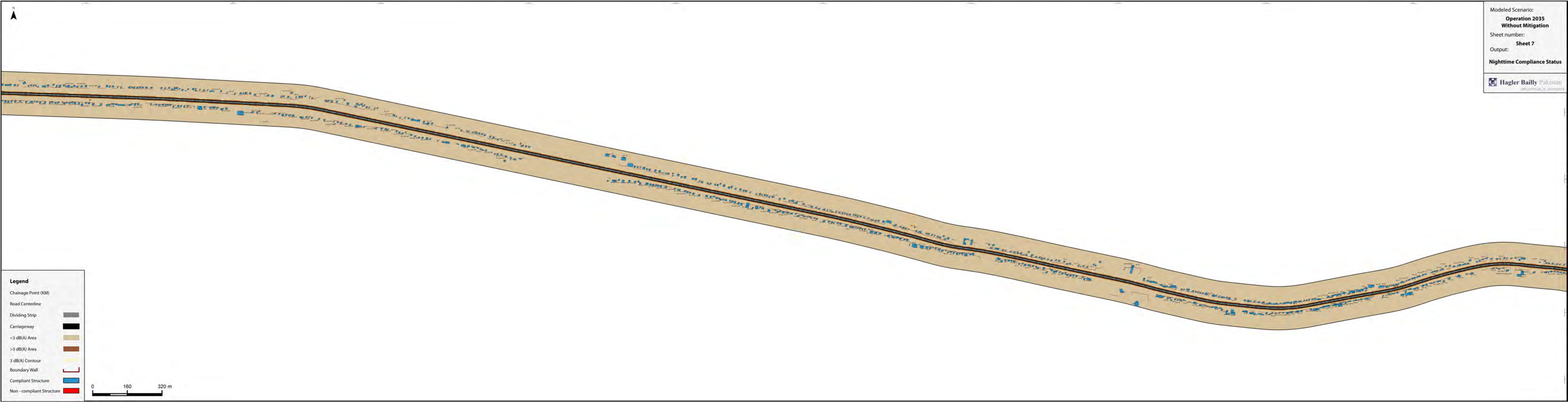

Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
<3 dB(A) Area
>3 dB(A) Area
3 dB(A) Contour
Boundary Wall
Compliant Structure
Non - compliant Structure
0
100
200 m
Modeled Scenario:
Operation 2035
Without Mitigation
Sheet number:
Sheet 5
Output:
Daytime Compliance Status
Hagler Bailly Pakistan

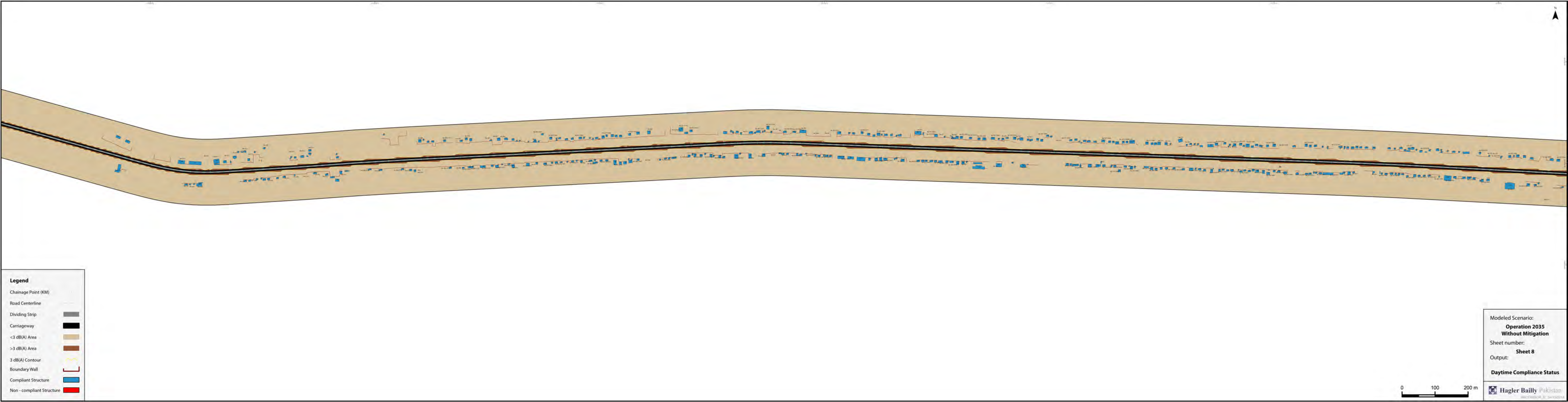

Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
<3 dB(A) Area
>3 dB(A) Area
3 dB(A) Contour
Boundary Wall
Compliant Structure
Non - compliant Structure
N
0
100
200 m
Modeled Scenario:
Operation 2035
Without Mitigation
Sheet number:
Sheet 5
Output:
Nighttime Compliance Status
Hagler Bailly Pakistan


Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
<3 dB(A) Area
>3 dB(A) Area
3 dB(A) Contour
Boundary Wall
Compliant Structure
Non - compliant Structure
0
100
200 m
Modeled Scenario:
Operation 2035
Without Mitigation
Sheet number:
Sheet 6
Output:
Daytime Compliance Status
Hagler Bailly Pakistan

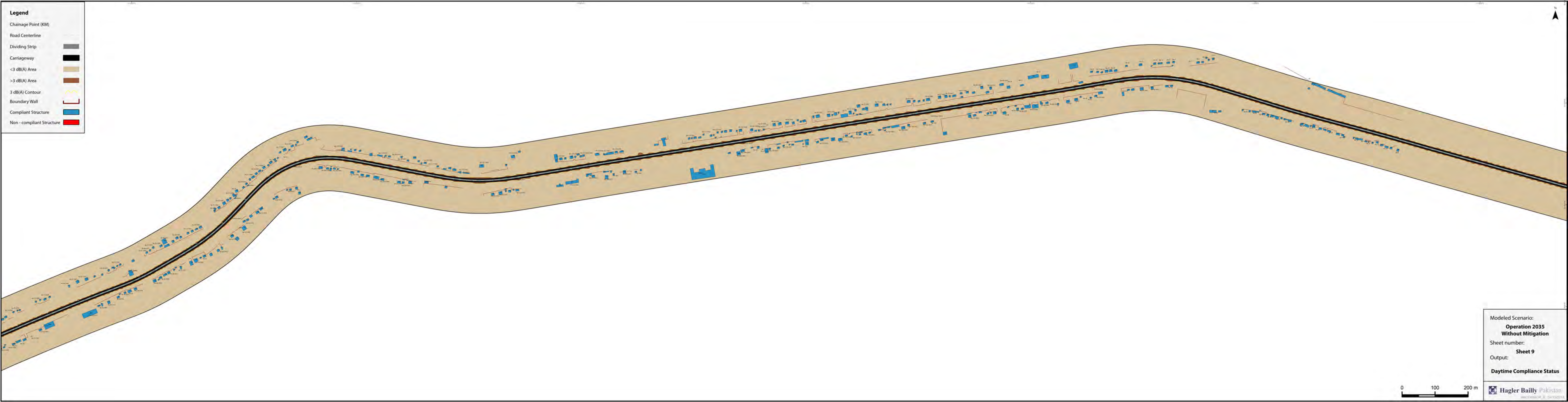

Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
<3 dB(A) Area
>3 dB(A) Area
3 dB(A) Contour
Boundary Wall
Compliant Structure
Non - compliant Structure
0
100
200 m
Modeled Scenario:
Operation 2035
Without Mitigation
Sheet number:
Sheet 6
Output:
Nighttime Compliance Status
Hagler Bailly Pakistan

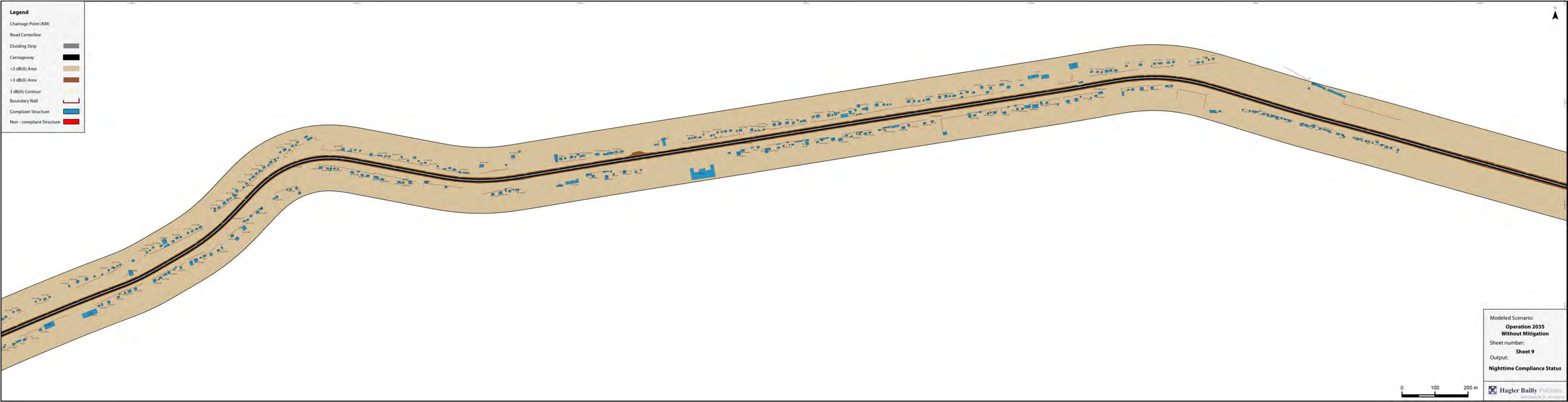

N
Modeled Scenario:
Operation 2035
Without Mitigation
Sheet number:
Sheet 7
Output:
Daytime Compliance Status
Hagler Bailly Pakistan
Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
<3 dB(A) Area
>3 dB(A) Area
3 dB(A) Contour
Boundary Wall
Compliant Structure
Non - compliant Structure
0
100
200 m


Modeled Scenario:
Operation 2035
Without Mitigation
Sheet number:
Sheet 7
Output:
Nighttime Compliance Status
Hagler Bailly Pakistan
Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
<3 dB(A) Area
>3 dB(A) Area
3 dB(A) Contour
Boundary Wall
Compliant Structure
Non - compliant Structure
0
160
320 m

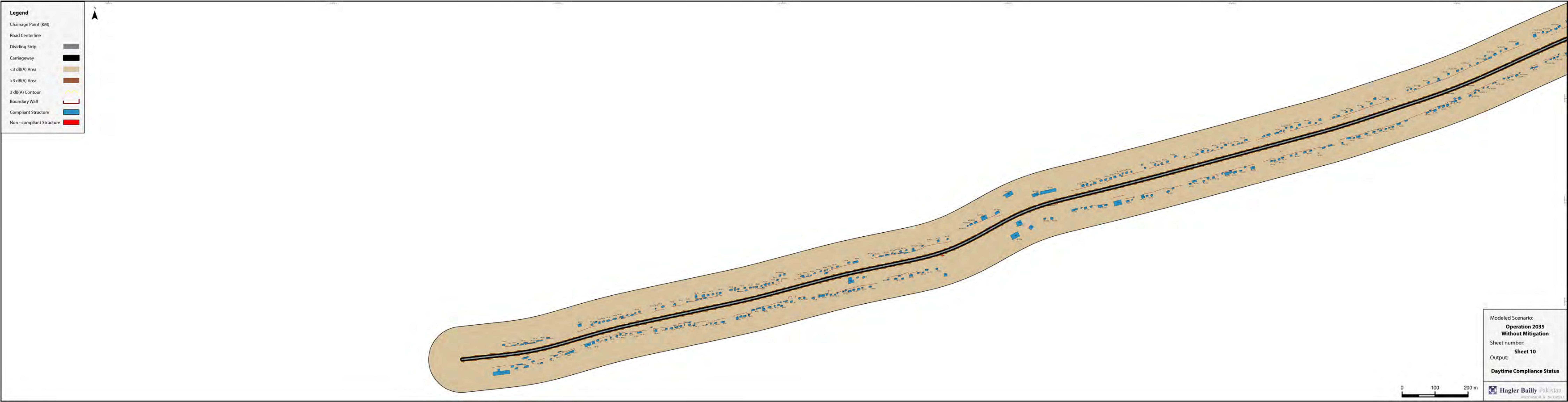

Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
<3 dB(A) Area
>3 dB(A) Area
3 dB(A) Contour
Boundary Wall
Compliant Structure
Non - compliant Structure
0
100
200 m
Modeled Scenario:
Operation 2035
Without Mitigation
Sheet number:
Sheet 8
Output:
Daytime Compliance Status
Hagler Bailly Pakistan


N
Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
<3 dB(A) Area
>3 dB(A) Area
3 dB(A) Contour
Boundary Wall
Compliant Structure
Non - compliant Structure
0
100
200 m
Modeled Scenario:
Operation 2035
Without Mitigation
Sheet number:
Sheet 8
Output:
Nighttime Compliance Status
Hagler Bailly Pakistan


Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
<3 dB(A) Area
>3 dB(A) Area
3 dB(A) Contour
Boundary Wall
Compliant Structure
Non - compliant Structure
Modeled Scenario:
Operation 2035
Without Mitigation
Sheet number:
Sheet 9
Output:
Daytime Compliance Status
0
100
200 m
Hagler Bailly Pakistan

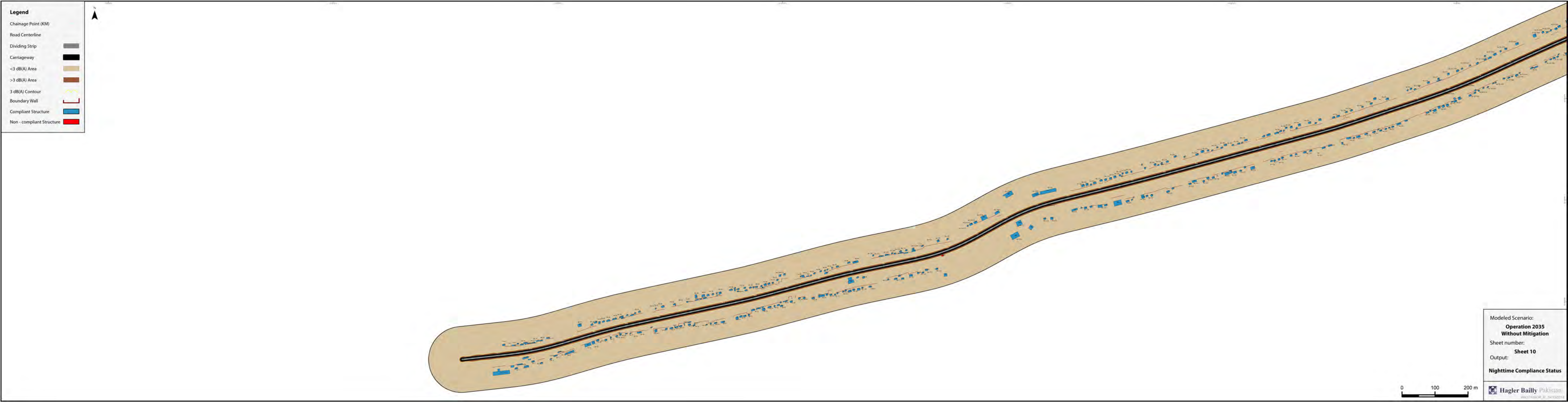


Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
<3 dB(A) Area
>3 dB(A) Area
3 dB(A) Contour
Boundary Wall
Compliant Structure
Non - compliant Structure
0
100
200 m
Modeled Scenario:
Operation 2035
Without Mitigation
Sheet number:
Sheet 9
Output:
Nighttime Compliance Status
Hagler Bailly Pakistan



Modeled Scenario:
Operation 2035 Without Mitigation
Sheet number:
Sheet 10
Output:
Daytime Compliance Status

Hagler Bailly Pakistan



Legend
Chainage Point (KM)
Road Centerline
Dividing Strip
Carriageway
<3 dB(A) Area
>3 dB(A) Area
3 dB(A) Contour
Boundary Wall
Compliant Structure
Non - compliant Structure
0
100
200 m
Modeled Scenario:
Operation 2035
Without Mitigation
Sheet number:
Sheet 10
Output:
Nighttime Compliance Status
Hagler Bailly Pakistan