

ORDERING PARTY:

**PUBLIC ENTERPRISE FOR STATE ROADS,
REPUBLIC OF NORTH MACEDONIA**

LOCATION:

MUNICIPALITIES OF: BITOLA, DEMIR HISAR

SUBJECT:

**ENVIRONMENTAL AND SOCIAL ASSESSMENT REPORT
(ESAR) FOR REHABILITATION OF THE ROAD SECTION
R1305 BETWEEN BITOLA – DEMIR HISAR**

TECHNICAL NUMBER:

022 – 03 – 19

Environment

Date: MARCH 2019



Drezdenska 52, 1000 Skopje, North Macedonia

Tel: +389 2 30 66 833/ +389 2 30 66 816

Fax: 02 3066 828

web: www.gim.com.mk

e-mail: gim@gim.com.mk



**CIVIL ENGINEERING INSTITUTE
MACEDONIA**

Drezdenska 52, 1000 Skopje, Macedonia
Tel: +389 2 30 66 833/ +389 2 30 66 816
Fax: 02 3066 828
web: www.gim.com.mk
e-mail: gim@gim.com.mk

Ordering Party:	PUBLIC ENTERPRISE FOR STATE ROADS, REPUBLIC OF NORTH MACEDONIA	
No. of Contract/Offer:	1001 – 1446/1	
Structure:	ROAD SECTION R1305 BETWEEN BITOLA – DEMIR HISAR	
Location:	MUNICIPALITIES OF: BITOLA, DEMIR HISAR	
Content:	ENVIRONMENTAL AND SOCIAL ASSESSMENT REPORT (ESAR) FOR REHABILITATION OF THE ROAD SECTION R1305 BETWEEN BITOLA – DEMIR HISAR	
Project Developer:	Civil Engineering Institute Macedonia Skopje	
Person in charge:	Gabriela Dudanova Lazarevska, MSc. in Engineering Technology	
Internal control:	Elena Nikolovska, MSc. in technical sciences, Environmental Engineering	
Collaborators:	Ivan Macanovski, B.Sc. in Mechanical Engineering Martina Blinkova Donchevska, B.Sc. in Ecology Elena Nikolovska, MSc. in technical sciences, Environmental Engineering Vesna Milanovikj, B.Sc. in Management of Ecological Resources Suzana Kasovska Georgieva, MA in Cultural Heritage	
Engineering Department	Date:	March 2019
	Technical number of the project:	022 - 03 - 19

<p>Engineering Department Director</p> <p>_____ Vlatko Ivanov, BSc. in Mechanical Engineering</p>	<p>General Manager</p> <p>_____ Miho Janevski, BSc. in Civil Engineering</p>
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Trade register and register of other legal entities

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Number: 0809-50/150120180053756

Date and time: 24.09.2018, 15:42:53

**CERTIFICATE
for registered activity**

CURRENT DATA FOR THE ENTITY	
Unique identification number of the entity	4067533
Name	Civil Engineering Institute "Macedonia" JSC-Skopje
Location	DREZDENSKA No. 52 SKOPJE – KARPOSH, KARPOSH

DATA FOR REGISTERED ACTIVITY	
Subject matter of work:	A general business clause has been registered.
Priority activity/ main revenue code	71.12 – Engineering activities and related technical consultancy
Other activities in the domestic circulation:	None
Recorded activities in the foreign circulation:	Yes
Approvals, permits, licenses, agreements:	<p>License for conducting energy control issued by the Ministry of Economy of the Republic of Macedonia no. 12-440/2 on 23.01.2015.</p> <p>License A for design of structures of first category issued by the Ministry of Transport and Communications of the Republic of Macedonia no. P.003/A, valid from 12.02.2016, to 12.02.2023.</p> <p>License A for construction of first category structures issued by Ministry of Transport and Communications of the Republic of Macedonia no. I.002/A, valid from 12.02.2014, to 12.02.2021.</p> <p>License A for review of design documentation of first category issued by the Ministry of Transport and Communications of the Republic of Macedonia no. R.014/A, valid from 26.01.2017 to 26.01.2024.</p> <p>License A for supervision over the construction of first category structures issued by the Ministry of Transport and Communications of the Republic of Macedonia no. N.001/A, valid from 12.02.2016 to 12.02.2023.</p> <p>License B for design of second category</p>



	<p>structures issued by the Ministry of Transport and Communications of the Republic of Macedonia no. P.006/B, valid from 12.02.2016, to 12.02.2023.</p> <p>License B for construction of second category structures issued by the Ministry of Transport and Communications of the Republic of Macedonia no. I.002/B, valid from 12.02.2014 to 12.02.2021.</p> <p>License B for supervision over the construction of second category structures issued by the Ministry of Transport and Communications of the Republic of Macedonia no. N.001/B, valid from 12.02.2016 to 12.02.2023.</p> <p>License for construction manager issued by the Ministry of Transport and Communications of the Republic of Macedonia no. 018, valid from 05.02.2015 to 05.02.2022.</p> <p>License for drafting urban plans by the Ministry of Transport and Communications of the Republic of Macedonia no. 018, valid from 28.02.2013 to 28.02.2023.</p> <p>Authorization for preparation of geological documentation, conducting and supervision of geological explorations, no. 11 issued by the Ministry of Economy of the Republic of Macedonia on 27.03.2015.</p>
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Prepared by:
(Illegible signature)

Authorized person:
(Illegible signature and a round stamp of the Central Register of RoM, Skopje)

Legal advice: Against this real act, an objection to the Central Registry of the Republic of Macedonia can be filed within 8 days from the day of receipt.

Потврдувам дека правилно го извршив преводот од македонски на англиски јазик со својот печат и потпис.

In witness that the foregoing translation from Macedonian into English language is correct, I do affix my seal and signature.

Јасмина Станковска

Jasmina Stankovska

Овластен судски преведувач

Authorized court translator

Датум: 29.10.2018

Date: 29.10.2018



Pursuant to the Law on Environment ("Official Gazette of RM" No. 53/05, 81/05, 79/06, 101/06, 109/06, 24/07, 159/08, 83/09, 1/10, 48/10, 124/10, 51/11, 123/12, 93/13, 187/13, 42/14, 44/15, 129/15, 192/15, 39/16 and 99/18), Article 18 and 19 from the Law on Construction ("Official Gazette of RM" No. 130/09, 124/10, 18/11, 36/11, 49/11, 54/11, 13/12, 144/12, 25/13, 79/13, 79/13, 137/13, 163/13, 27/14, 28/14, 42/14), and in accordance with the signed Contract for designing no. 1001-1446/1 from 10.08.2018, and in accordance with Article 19 from the Statute of the Institute for Environment, Civil Engineering and Energy - Skopje, the Director adopts the following:

D E C I S I O N

For appointing Designers for preparation of the Environmental and Social Assessment Report (ESAR) for rehabilitation of the road section R1305 between Bitola – Demir Hisar, based on Contract no. 1001-1446/1 from 10.08.2018:

Detailed Design NRRRP NATIONAL AND REGIONAL ROADS REHABILITATION PROJECT LOT 2, Book 5, R1305 BITOLA – DEMIR HISAR L=10km

The documentation shall be elaborated by the employees at the Institute for Environment, Civil Engineering and Energy - Skopje, as follows:

Designer in Charge:

Gabriela Dudanova Lazarevska, MSc. in Engineering Technology

Associates:

Ivan Macanovski, B.Sc. in Mechanical Engineering

Martina Blinkova Donchevska, B.Sc. in Ecology

Elena Nikolovska, MSc. in technical sciences, Environmental Engineering

Vesna Milanovikj, B.Sc. in Management of Ecological Resources

Suzana Kasovska Georgieva, MA in Cultural Heritage

The persons stated above will be engaged until the completion of the documentation, in accordance with the concluded Contract and the Terms of Reference.

This Decision shall enter into force on the day of its adoption and submission to the appointed persons.

EXPLANATION

In accordance with the Law on Construction and the concluded Contract no. 1001-1446/1 from 10.08.2018 the Designer shall be obliged to prepare the Environmental and Social Assessment Report professionally and with quality, and he/she shall be responsible for the compliance of the Design with the conditions for designing, for which a Decision is adopted as in the Disposition.

Submitted to the following:

- Client
- Engineering department
- Appointed persons
- Sector for Legal Services and Human Resources
- Archive

**Civil Engineering Institute Macedonia Skopje
General Manager**

Miho Janevski, BSc. in Civil Engineering

PUBLIC ENTERPRISE FOR STATE ROADS
Republic of North Macedonia



**ENVIRONMENTAL AND SOCIAL ASSESSMENT REPORT (ESAR) FOR
REHABILITATION OF THE ROAD SECTION R1305 BETWEEN BITOLA –
DEMIR HISAR**



Skopje, March 2019

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LIST OF ABBREVIATIONS

BP	Bank Procedure
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPSAU	Environmental Protection and Social Aspects Unit
ESAR	Environmental and Social Assessment Report
ESMMP	Environmental and Social Management and Monitoring Plan
EU	European Union
IPMU	International Projects Management Unit
NTS	National Transport Strategy
NRRRP	National and Regional Road Rehabilitation Project
MoEPP	Ministry of Environment and Physical Planning
OD	Operational Directive
OP	Operational Policy
PCE	Public Communal Enterprise
PESR	Public Enterprise for State Roads
PHI	Private Health Institution
PIU	Project Implementation Unit
RNM	Republic of North Macedonia
WB	World Bank

1. Executive summary

National and Regional Roads Rehabilitation Project (NRRRP) is a project supported through a loan financed by the World Bank. This project implements the National Transport Strategy (NTS) of the Republic of North Macedonia.

The Project is consistent with the National Transport Strategy (2007-17), which sets out improved road connectivity to the Corridors as the national priority after the completion of Corridors X and VIII. The strategy highlights the important role of roads in promoting the country's competitiveness and harmonious development through ensuring that the national road network is connected efficiently to the corridors and existing bottlenecks are eliminated.

This Project represents the implementation of the last phase of NRRRP for the period 2017-2018 and covers the following:

- improvement of condition on state road network by means of rehabilitation of approximately 125 km of the existing roads;
- increase of road safety condition through appliance of measures for improvement of road safety in all phases of the Project implementation.

The institution in charge for the Project implementation is the Public Enterprise for State Roads (PESR). Within the PESR there is a Project Implementation Unit (PIU) responsible for implementation of all necessary activities and actions for successful management and completion of the Project.

One of the Category B sub-projects under the WB project of National and Regional Road Rehabilitation Project (NRRRP) is the rehabilitation of the road section R1305 between Bitola – Demir Hisar.

The road specific Elaborate for environmental protection is an integral part of the overall project documentation developed for rehabilitation activities according the North Macedonian National legislation in field of environmental protection, especially the Law on Environment (“Official Gazette of RM” No. 53/05, 81/05, 79/06, 101/06, 109/06, 24/07, 159/08, 83/09, 1/10, 48/10,124/10, 51/11, 123/12, 93/13, 187/13, 42/14, 44/15, 129/15, 192/15, 39/16 and 99/18)¹. Elaborate for environmental protection should be approved by Administration of Environment within the Ministry of Environment and Physical Planning (MoEPP).

According to the WB policy on Environmental Assessment (OP 4.01), Involuntary Resettlement (OP 4.12), and other environmental and social policies, such projects should be analyzed to determine the potential for negative and positive environmental and social

¹ Article 24 - Elaborate for environmental protection

impacts and to avoid, compensate and/or mitigate the adverse negative impacts on the environment.

In order to ensure the environmental compliance of the proposed project and to meet the requirements of the World Bank Safeguard Policy OP 4.01 Environmental Assessment and Environmental and Social Assessment Report (ESAR) including Environmental and Social Management and Monitoring Plan (ESMMP) has been developed for this project. The proposed rehabilitation activities for the road section between Bitola – Demir Hisar, is determined in detail by respective Environmental and Social Assessment Report (ESAR).

The road is located in the southern part of North Macedonia, and the connection of Corridor Xc Gradsko – Prilep - Bitola (A3e) junction Krklino with direction to the north to connect with new motorway Skopje – Ohrid close to Kicevo and has significant traffic and economic importance for the municipalities connected and for the road network in the Republic of North Macedonia.

Starting point of the alignment is on junction with A3e at Krklino with coordinates N 41°04'31" and E 21°20'31". The end of the road alignment is close to Demir Hisar (on junction with new motorway) with coordinates N 41°12'48" and E 21°12'17".

Road is in flat terrain. The current road conditions on this section, at certain places along the section there are intensive network cracks, potholes, longitudinal and traverse cracks and rutting's where determined. Along the settlements sidewalks are constructed.

Potential impacts of the project on the environment and social setting is assessed in this Environmental and Social Assessment Report (ESAR) which is developed to meet the requirements of North Macedonian National legislation and World Bank Environmental and Social Safeguards.

Potential environmental and social impacts as result of implementation of the project activities i.e rehabilitation of the road section will be local, short-term and insignificant. Implementation of proper mitigation measures during rehabilitation activities will ensure reduction of the adverse project impacts to acceptable levels.

Moreover, the rehabilitation of the road section will improve technical conditions of this road and therefore, will contribute to safe, fast, economic and comfortable road traffic.

2. Policy, legal and administrative framework

The Environmental Assessment process is intended to serve as a primary input for the decision-making process by North Macedonian authorities and the World Bank, which have to approve the project before it can be implemented.

North Macedonian Framework

Republic of North Macedonia has developed full legal and institutional framework for Environmental Assessments. This framework is generally in compliance with the existing World Bank Environmental Assessment rules and procedures as well as in compliance with the EU EIA Directives. Environmental Impact Assessment of certain projects is required to be carried out in accordance with Articles 76-94 of the Law on Environment (“Official Gazette of RM” No. 53/05, 81/05, 79/06, 101/06, 109/06, 24/07, 159/08, 83/09, 1/10, 48/10, 124/10, 51/11, 123/12, 93/13, 187/13, 42/14, 44/15, 129/15, 192/15, 39/16 and 99/18).

The types of projects that require an EIA should be determined in accordance with Article 77 of the Law on Environment, which are specified in details in the “Decree for Determining Projects for which and criteria on the basis of which the screening for an environmental impact assessment shall be carried out” (“Official Gazette of RM” No. 74/05). According to this Decree, a *full EIA Study* for this project activities is not needed (only construction of new highway and national or regional road or widening of existing road with additional two lanes is subject to full EIA Study).

In accordance with Article 24 of the Law on Environment for the project activities that do not need to carry out the procedure for environmental impact assessment (do not need to prepare full EIA Study), it is obligation to be prepared *Elaborate* for environmental protection before submitting the project implementation.

The Ministry of Environment and Physical Planning (MoEPP) has been prepared Rulebook for implementing, screening, scoping and review in environmental impact assessment in the Republic of North Macedonia. An aim of this Rulebook is to assist in the interpretation of the EIA laws so that they can be applied in practice. The rehabilitation activities of the section R1305 between Bitola – Demir Hisar is covered by Decree amending the Decree for actions and activities for which is obligatory preparation of an *Elaborate for environmental protection* for which approval the Ministry of Environment and Physical Planning is competent authority (“Official Gazette of RM” No. 36/12) (XI - Infrastructure Projects, 15 - Reconstruction of Motorways and Magistral Roads for more than 10 km).

The *Elaborate* for environmental protection is required to identify and describe the negative and positive impacts on medias and areas of the environment – water quality, air quality, waste management, noise protection, protection of the biodiversity, as well as the social

impacts – improvement of the economy, traffic conditions, etc., and define proper mitigation measures during rehabilitation activities to reduce or mitigate impacts to acceptable levels.

World Bank Environmental and Social Safeguard Policies

World Bank environmental and social safeguard policies are regarded as a corner stone of its support to sustainable poverty reduction. The objective of these policies is to prevent and mitigate harm to people and their environment in the development process. These policies provide guidelines for the WB and borrowers in the identification, preparation and implementation of programmes and projects. Environmental Impact Assessment (EIA) is 1 (one) of 10 (ten) environmental, social and legal safeguard policies of the WB. Environmental Impact Assessment (EIA) is used to identify, avoid and/or mitigate the potential negative environmental impacts associated with lending operations. The purpose of EIA is to improve decision making, to ensure that project options under consideration are sound and sustainable, and that potentially affected people have been adequately consulted. The WB's environmental assessment policy and recommended processing are described in *Operational Policy (OP)/Bank Procedure (BP) 4.01: Environmental Assessment*. This policy is considered to be the 'umbrella' policy for WB environmental 'safeguard policies'.

For the present road section R1305 between Bitola – Demir Hisar the relevant safeguard policies to be considered at all stages of preparation and planning are:

- Operational Policy on Environmental Assessment (OP 4.01, 1999, revised April 2013);
- Operational Policy on Physical Cultural Resources (OP 4.11, 2006);
- Operational Policy on Natural Habitats (OP 4.04, 2001);
- Policy on Access to Information (2013).

The WB OP/BP on Involuntary Resettlement requires WB-assisted projects to avoid or minimize involuntary land taking. If such cannot be avoided, displaced persons need to be meaningfully consulted, compensated for lost/damaged assets and assisted in restoring or improving their living standards and livelihood.

The WB OP/BP on Natural Habitats seeks to ensure that WB-supported infrastructure and other development projects consider the conservation of biodiversity, as well as the numerous environmental services and products which natural habitats can provide to human society.

The policy strictly limits the circumstances under which any WB-supported project can damage natural habitats, i.e. such land and water areas where most of the native plant and animal species are still present. Specifically, the policy prohibits WB support for projects

which would lead to significant loss or degradation of any Critical Natural Habitats, whose definition includes those natural habitats which are either:

- legally protected;
- officially proposed for protection;
- unprotected but known of high conservation value.

In other (non-critical) natural habitats, WB-supported projects can cause significant loss or degradation only when:

- there are no feasible alternatives to achieve the project's substantial overall net benefits; and
- acceptable mitigation measures, such as compensatory protected areas, are included within the project.

At the Project level, WB seeks to ensure that its lending operations comply with international obligations to protect biodiversity. EIAs for WB should consider the impacts of proposed project on a country's biodiversity.

The WB OP/BP on Forestry aims to reduce deforestation, enhance the environmental contribution of forested areas, promote afforestation, reduce poverty and encourage economic development.

The WB OP on Cultural Property is based on the acknowledgement of cultural resources as sources of valuable historical and scientific information, as assets for economic and social development, and as integral parts of a people's cultural identity and practices. WB policy as stated in Operational Directive (OD) 4.50 is to: (a) assist in protecting and enhancing cultural property through specific project components and (b) decline to finance projects which significantly damage cultural property and assist only those that are designed to prevent or minimize such damage.

3. Project description

National and Regional Road Rehabilitation Project (NRRRP) is a project supported through a loan financed by the World Bank. This project implements the National Transport Strategy (NTS) of the Republic of North Macedonia.

The Project is consistent with the National Transport Strategy (2007-17), which sets out improved road connectivity to the Corridors as the national priority after the completion of Corridors X and VIII. The strategy highlights the important role of roads in promoting the country's competitiveness and harmonious development through ensuring that the national road network is connected efficiently to the corridors and existing bottlenecks are eliminated.

This Project represents the implementation of the last phase of NRRRP for the period 2017-2018 and covers the following:

- improvement of condition on state road network by means of rehabilitation of approx. 125 km of the existing roads;
- increase of road safety condition through appliance of measures for improvement of road safety in all phases of the Project implementation;

The institution in charge for the Project implementation is the Public Enterprise for State Roads (PESR). Within the PESR there is a Project Implementation Unit (PIU) responsible for implementation of all necessary activities and actions for successful management and completion of the Project.

According to the conceptual design, rehabilitation of 12 road routes is foreseen, one of the routes for rehabilitation is part of LOT 2: Bitola – Demir Hisar.

The subject section is located in the southern part of the Republic of North Macedonia, and the connection of Corridor Xc Gradsko – Prilep - Bitola (A3e) junction Krklino with direction to the north to connect with new motorway Skopje – Ohrid close to Kicevo and has significant traffic and economic importance for the municipalities connected and for the road network in the Republic of North Macedonia. For this specific road it is important to mention that this ESAR only refers to 10 km of the A3e section, i.e. the section Bitola – Demir Hisar.

3.1 Current situation of the road

The current road conditions on this section, at certain places along the section there are intensive network cracks, potholes, longitudinal and traverse cracks and rutting's where determined. Along the settlements sidewalks are constructed. From services along the entire section, there are several locations with parking lots and stops for public transport. There are also service stations and gas stations along the road. On the section there is a problem with the drainage system, which is not maintain properly and therefore not fully functional. Part of road have been constructed by stone cubes and later overlay by asphalt.

The road section R 1305 section is a regional road. Th road section is Bitola – Demir Hisar and has a significant traffic and economic importance of the road network in the municipalities of Bitola and Demir Hisar and the road network in the Republic of North Macedonia.

Section 1

The Design plans the upgrade of the section of the existing carriageway from km -0 + 019,49 to km 3 + 011,14, and the elevation fitting to the surrounding street network that gravitates around the regional road, in the section where the existing road passes through the settlement Kukurecani, and generally follows the configurations of the surrounding terrain. At this section, the carriageway has two traffic lanes with a total width of about 8.0 m (7.50 - 9.0 m) and shoulders on both sides of the road with an average width of 1.30 m, while through the settlement Kukurecani (km 2+682,83 – km 3+227,38) on the left side of road, sidewalk was constructed with width of about 1.50 m.

Section 2

The Design plans the reconstruction of the section of the regional road from km 3 + 011,14 to km 10 + 015,01, and the level fitting to the surrounding street network that gravitates around the regional road, and generally follows the configuration of the surrounding terrain. At this section, the carriageway has two traffic lanes with variable width of about 6.0 - 6.5 m and shoulders with average width of 1.00 m.

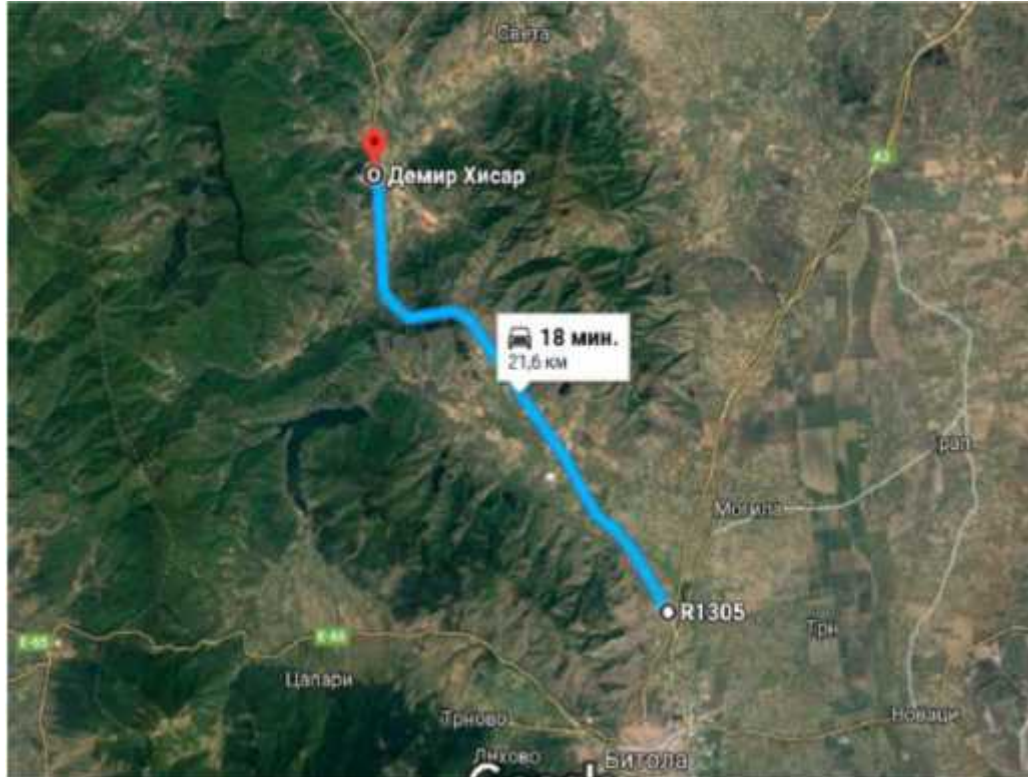


Figure 1 Location of the road Bitola – Demir Hisar

Subject section of R1305 road stretches through one settlement Kukurecani. On the approaches to the settlement and urban areas within there are no visible differences between previous rural and following, urban area.



Figure 2 Beginning of existing sidewalk on left side in settlement Kukurecani - Gap in existing sidewalk

Sidewalks are foreseen only on short road sections within urban areas causing pedestrian movements on carriageway and decreasing pedestrian safety (see pictures above). Pedestrian crossings have been implemented only in front of primary school in settlement Kukurecani and without any traffic calming measure used.



Figure 3 Cross section in settlement Kukurecani

The width of the carriageway in settlement Kukurecani is predominantly 7.7 m. Wider traffic lanes encourages over speeding and decrease road safety, especially within built-up areas where mixed traffic and vulnerable road users could be expected.

Also, sidewalk is constructed only on left side of the road (looked towards Demir Hisar), causing pedestrian movement along carriageway on right side of the road.



Figure 4 Unmaintained shoulder could cause water retention on carriageway- Intersection for settlement Crnobuki at km 3+623

On the section, there is problem with drainage system, which is not maintain properly and therefore not functional. Recommendation is to improve regular maintenance with special attention to the drainage system.

Intersection for settlement Crnobuki is located at km 3+623 (end of settlement Kukurecani), on right side of the road looked towards Demir Hisar. Intersection geometry is defined as "Y" type, encouraging higher speed during exiting from main road towards settlement Crnobuki and entering to the main road towards Bitola.



Figure 5 "Y" intersection point for settlements Dragozani and Brana Strezevo at km 4+820

Bus stops are located on the main road and before intersection (both approaches) creates additional conflict points and decrease road safety. Most of the bus stops are noted unregulated, without properly constructed bus-bay and sidewalks for passengers. On several locations, it is noted that bus stops are foreseen only in one road direction. This situation is illogical and could cause bus stopping on inappropriate places, decreasing road safety Sidewalks between bus stops and on approaches to the intersection are not foreseen on site, decreasing pedestrian safety.

Reconstruction of the existing intersection into roundabout should be reconsidering at this location. Having in mind needs for bus stops and consequently pedestrian movements between, roundabouts is most suitable solution from road safety perspective. Reconstruction of existing intersection into roundabout demands additional surveys at this location.

Considering state road category, all bus stops along the road section should be defined as bus-bays. Also, sidewalks between bus stops in opposite directions as well as between bus stop and local roads nearby should be foreseen. Bus stops should be properly marked with traffic signs and road markings.



Figure 6 Pedestrians on right side of the road - End of sidewalk in settlement Kukurecani

Along the inspected road section there are partly build pedestrian infrastructure provided for safe movement of pedestrians only in the settlement Kukurecani. Existing sidewalk in the settlement is constructed only on left side, looked towards Demir Hisar and is in poor condition why it is often avoided by pedestrians. The pedestrian movement of these insecure and dangerous parts has been noted especially in places with social content (playground, bus stops, shops, etc.). In such cases, accidents with road vehicles and road may occur, in the absence of a safe walkway for pedestrians.

There are several small bridges on the section without or with incorrectly guardrail for vehicles. All guardrails are in poor conditions, damaged or missed.

Having in mind the class of the road (regional) but with function of street in settlement Kukurecani, physical separation of pedestrians from road users should be provided along the settlements. Therefore, existing sidewalk should be extended and connected from the beginning to the end of settlement Kukurecani. Existing sidewalk stretches in poor condition should be reconstructed in order to be attractive to pedestrians.

Having in mind fact that houses and other objects are located on both sides of the road, sidewalk should be constructed also on right side in subject settlement (looked towards Demir Hisar). Recommended minimal width of sidewalk is 1.6 m.

Pedestrian movements on both sides of the road should be connected via pedestrian crossings. Locations of the pedestrian crossings should be examined and pedestrian crossings should be marked (nearby places of social attraction like playgrounds, bus stops, etc.).



Figure 7 Pedestrian crossing in school area - settlement Kukurecani

In settlement Kukurecani there is pedestrian crossings in the school area. Traffic signs for school area are damaged and road markings of these crossings are in poor conditions.

Parking should be marked and better organised. Manoeuvring while parking can lead to crashes due to poor parking angles and sight distance, so angled parking should be provided.

Along the analysed section, there is no petrol station but there are multiple rest areas/parking areas and several restaurants.

The existing fence along the section in question is in poor condition and is not maintained and has a negative impact on the safety of the road user. In certain parts, it is covered with greenery. This reduces the visibility of the fence and reduces the functionality of the systems.

3.2 Technical Characteristics of the Project

For the subject section Bitola – Demir Hisar, within the regional road R1305, the task of the project program is to give a design solution for rehabilitation of the existing regional road with the required: structure, dimensions and structural details for performing the works on a Detailed Design level.

The rehabilitation of the section in question Bitola – Demir Hisar is planned for the section between km 0+000,00 and km 10+000,00 and it can be divided into 2 (two) parts, in accordance with the planned rehabilitation, as follows:

- ✓ *Section 1*: upgrade of the existing pavement from km 0+000 to km 3+010,
- ✓ *Section 2*: rehabilitation of the existing pavement at section from km 3+010 to km 10+000.

Methodology of research and examination

For preparation of this part of the Report, an analysis was carried out using the following methods:

- Field research,
- Tacheometric survey.

Field research (i.e. visual inspection of the pavement)

During the on-site inspection of the pavement on two sections where rehabilitation will be performed, the following damages have been observed:

- ✓ *Section 1*: at this part, the following damages of the carriageway are noticed which appear in larger scale in respect to the other parts:
 - net fractures and crocodile cracking,
 - patched potholes,
 - local landslides,

- collapsed and/or grassed shoulders,
 - local rehabilitations,
 - ruts,
 - degradation of the surface asphalt layer.
- ✓ *Section 2:* at this part, the following damages of the carriageway are noticed:
- net fractures and crocodile cracking,
 - patched potholes,
 - collapsed and/or grassed shoulders,
 - local rehabilitations,
 - ruts,
 - folds and extrusion of the surface asphalt layer.

Tacheometric survey

For determining the structural elements of the existing alignment and setting the axis, detailed tacheometric survey of the alignment was conducted in the following manner: placing of operational polygon traverse along the entire length of the alignment.

The points of the polygon traverse are made from concrete elements with certain dimension that are trenched in the surrounding terrain at a certain length along the road i.e. at a distance not more than 250 m.

Then, the operational polygon traverse was measured with its absolute coordinates and height in reference to the constant geodetic points with their absolute values X, Y and Z.

After the performed geodetic survey of the traverse, the alignment was staked out and surveyed. The staking out of the alignment was carried out by placing steel spikes at the left and right edge of the asphalt pavement at every 10 m and/or red oil paint.

Also, the existing structures along the alignment were surveyed, i.e. the existing culverts, ditches, stops, bridges, etc.

Using all the performed geodetic measurements, current geodetic layout was prepared by using software for terrain modelling processing.

Elements of the geometrical cross section

The elements of the geometrical cross section are dictated by the current state of the terrain and they are as follows:

Section 1 - km -0+019,49 to km 3+011,14
traffic lanes 2 x 3.50 m

edge lanes 2 x 0.30 m
pavement section 7.60 (8.50) m
shoulders 2 x 1.00 m
roadbed 11.50 (10.50) m

Section 2 - km 3+011,14 to km 10+015,01

traffic lanes 2 x 3.00 m
edge lanes 2 x 0.30 m
pavement section 6.60 (6.00) m
shoulders 2 x 1.00 m
roadbed 7.00 (6.50) m

Specific and Critical Cross Sections

The specific conditions of the distinctive and critical cross sections are determined with geodetic survey, processing and presentation of the data.

Based on the original surveyed data and the data tabulated in the longitudinal section, cross sections are designed as detailed solutions presented in scale 1:100 in Detailed Design.

Layout Plan (horizontal design)

The basis for defining the horizontal solution i.e. the road axis is based on the geodetic data by using the current pavement of the regional road R1105. Fine movement of the road axis was performed by using the surveyed points from the geodetic measuring in order to obtain precise monitoring of the existing pavement at R1105.

In general, the alignment of the highway section in question stretches from northwest to southeast.

The beginning of the alignment at km -0+019,49 is located after the exits from the interchange with road direction A3, section Prilep-Bitola, near the settlement Krklino, while the end of the rehabilitation is at km 10+015,14, near the settlement Lopatica.

The road axis is in the middle of the current road. It is designed with directions, with horizontal circular arcs projected in the vertices of their refractions with the angle of refraction greater than 3° interconnected with the transversal curves. The formation of the circular arcs was made with radii $R=250-1.750\text{m}$.

All details are presented in the layout plan for the alignment in scale of 1:1.000 in Detailed Design.

Vertical design

The vertical solution of the alignment is defined with the finish grade line which has been determined as a section of one vertical plane laid over the road axis in layout. Geometrically, the finish grade is composed of directions (uphills and downhills of the alignment) and vertical curves (convex and concave curves). The finish grade straights have been defined with their gradients, while the vertical curves have been determined with the curvature radii.

The limit values of the designed elements are determined according to the dynamics, exploitation and structural elements, while the applied sizes are chosen by the rules for design and the terrain conditions.

The vertical solution of the alignment is conditioned by the design conditions and the current terrain state since it is about rehabilitation i.e. the finish grade of the current carriageway is monitored to the maximum.

After the axis of the current carriageway is defined, cross section of the alignment is prepared with a terrain line or line of the carriageway's surveyed levels.

The initial level of the finish grade at -0+029,57 is 598,52, while at the end at 10+044,87 is 644,55, which means that in general the finish grade is in a descent in the direction of the chainage.

After the adjustment of the new warping of the current road, and taking into account the cross gradient of the current pavement structure, as well as the dewatering conditions, preparation of cross profiles on the road has commenced.

In order to satisfy the upgrade conditions, frequent fracturing of the finish grade is conducted i.e. depending on the existing gradient of the pavement structure.

The longitudinal gradients of the finish grade follow the existing finish grade of the road and their values are up to 2.85%, while the breaks of the finish grade are rounded with vertical curves between 800 m and 70,000 m.

Appropriate vertical curves are fitted in the breaks where there are larger differences in the gradient of $i=0.3\%$, as well as in the smaller breaks for adjustment towards the existing finish grade.

In the longitudinal section, besides the basic data as part of this appendix for vertical presentation of the terrain and the road axis, the warping, cross gradients and levels of left and right edge with the terrain levels are also presented.

All the details that are subject of the longitudinal section are presented in the longitudinal section, in scale 1:100/1.000 in Detailed Design.

Pavement Structure

The dimensions of the pavement structure have been taken in accordance with the solutions from the Conceptual Design:

- Wearing course WC16 d = 5 cm,
- Levelling bituminous base course BBC 32 d = 7 cm,
(locally, if required)

Since only rehabilitation activities are foreseen for this road section, no active processing of raw materials is envisaged on the temporary construction sites. The construction material that will be used will not be obtained from borrow pit, it will be obtained from quarries that already has obtained an environmental permit (B IPPC permit). In accordance with the Law on Environment, this permit is issued by the local environmental authorities and it is supervised by the Local Environmental Inspectorate. The insight in the suppliers' environmental permit will be available on request.

Dewatering

The carriageway dewatering is planned by using existing elements for dewatering, cleaning and arranging the ditches and culverts.

Traffic and Technical Equipment

The Conceptual Design plans to treat the traffic signalization, both horizontal signalization and traffic signs, and according to that a traffic design is going to be prepared after project documentation approval, before project implementation.

4. Baseline data

4.1 Description of the environment around the project location

The activities provided for rehabilitation of the section Bitola – Demir Hisar will take place in southern part of North Macedonia in the municipalities of Bitola and Demir Hisar and has a significant traffic and economic importance of the road network in the municipalities of Bitola and Demir Hisar and the road network in the Republic of North Macedonia.

The municipality of Bitola is located in the south-western part of the Republic of North Macedonia. In the west, the municipality borders with the municipality of Resen, where the border between the two municipalities passes through the Baba Mountain. The southern border is the state border with Greece. In the east and northeast, the municipality of Bitola is bordered by the municipality of Novaci and the municipality of Mogila, while in the north with the municipality of Demir Hisar. The municipality is located in the Pelagonia Valley, reaching the highest peaks of Mountain Baba with the peak Pelister. Black River flows through the municipality.

Surface in km²:

- City of Bitola 26.37 km²;
- 65 villages 768.16 km²;
- Total municipality of Bitola 794.53 km².

Demir Hisar, or as it is called the Iron Mountain, is an area located in the southwestern part of the Republic of North Macedonia, or northwest of the Pelagonija lowlands, around the upper basin of Crna Reka with its tributaries. For the most part, the relief is hilly and mountainous, and a small part of the stream of Crna Reka is lowland.

4.2 Geological features of the region

The Republic of North Macedonia has a very complex geological structure. Thus, according to the geological evolution and the geological composition, on the territory of the Republic of North Macedonia there are rocks of almost all geological eras and periods from pre-preamble to the youngest quartile period (see the figure below).

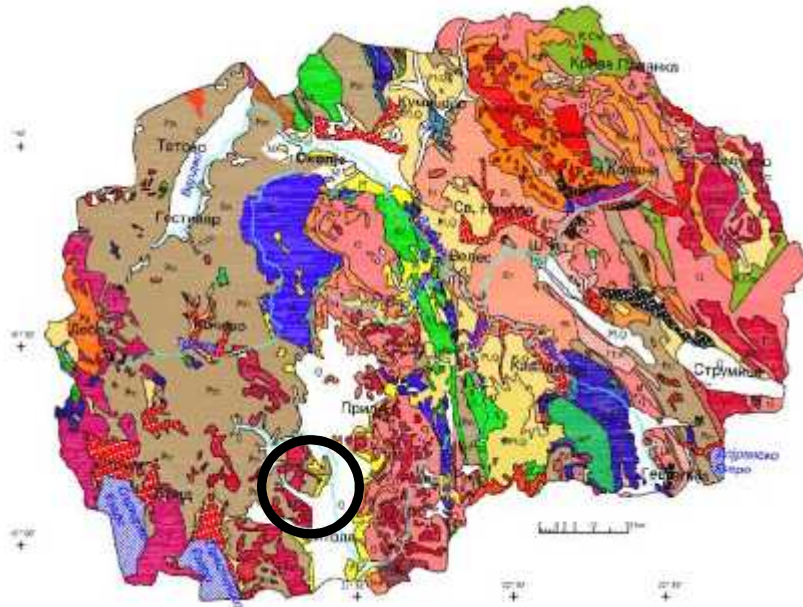


Figure 8 Geological map of the Republic of North Macedonia

The diversity of geological, relief and vegetation opportunities and especially the impact of man and climatic conditions allow for the meeting of many types of soils. The basic type of genetic land in Pelagonija is the smolder. Smokers are hydrogen and they formed on the lake silt after the expiration of the former Pelagonia lake. These soils are used for cereal industrial and horticultural crops. The deposits of alluvial soils range from ten centimeters to several meters. The alluvial soils are concentrated production of garden and industrial crops. Deluvial soils are located on the outskirts of the city. These are young soil types with a small percentage of humus 1-2% that require fertilization. The most common types of soil in Pelagonia are hydrogen spars, marshy clay soils, alluvial, deluvial soils, cinnamon forest soils, lying soils, and on smaller areas there are salty soils. In the Pelagonia valley, especially in the Bitola area, layers of coal - lignite are discovered. The mine "Suvodol" is located at the foothills of Selecka Mountains about 15 km east of Bitola. In the vicinity of this mine, there are coal deposits in two other sites: Brod-Gneotino and Zhivojno. The Demir Hisar region is represented by alluvial and diluvial soils. Alluvials are represented in the plain part of the river Crna and Stara reka, which are soils with a deep physiologically active layer, favorable mechanical composition and water-air regime, as well as relatively good chemical properties. Deluvial soils are also represented in the plain part of both sides of the river Stara Reka, on the left side of the river "Crna". The production capacities of these soils are lower due to topographic and hydrographic conditions and physical properties. These soils are poorly supplied with water, contain significantly less humus and nutrients and have unfavorable chemical and physical properties.

The geomorphological appearance of the municipalities of Bitola and Demir Hisar is characterized by the fact that several relief forms are encountered, including traces of

Paleorelief, old river Preseren valleys, traces of fluvial surfaces and terraces, abrasive relief, denudation forms and the like. On Baba Mountain and Pelister there are also geomorphologic shapes such as stonemasons and sapares, as well as rocky rivers or saper. Stone rivers are made up of granites, granodiorites, crystalline shales, filites, gneisses and other rocks.

Bitola and the wider surroundings are also known for their diverse mineral wealth. This particularly applies to large amounts of lignite and other non-metals.

Based on these natural reserves, since 1983, the largest electro-mechanical facility in North Macedonia, the Mining-Energy Complex REK-Bitola, operates. Another significant large capacity of wider social significance is the hydromeliorative giant Strezevo.

According to the previous research, in the municipality of Demir Hisar, exploitation exists only on deposits of calcium carbonate (limestone). In the municipality there are deposits of clay used for pottery production, and it is used by the population of the municipality of Kichevo. There is excavation of marble, among which the most common are travertine and kaolin.

4.3 Basic hydro-geological features of the terrain

Hydro-geological features of this subject section are categorized by lithological members and according to their hydrogeological function, are divided into: hydrogeological collectors, hydrogeological conduits and hydrogeological insulators (see Figure 9).

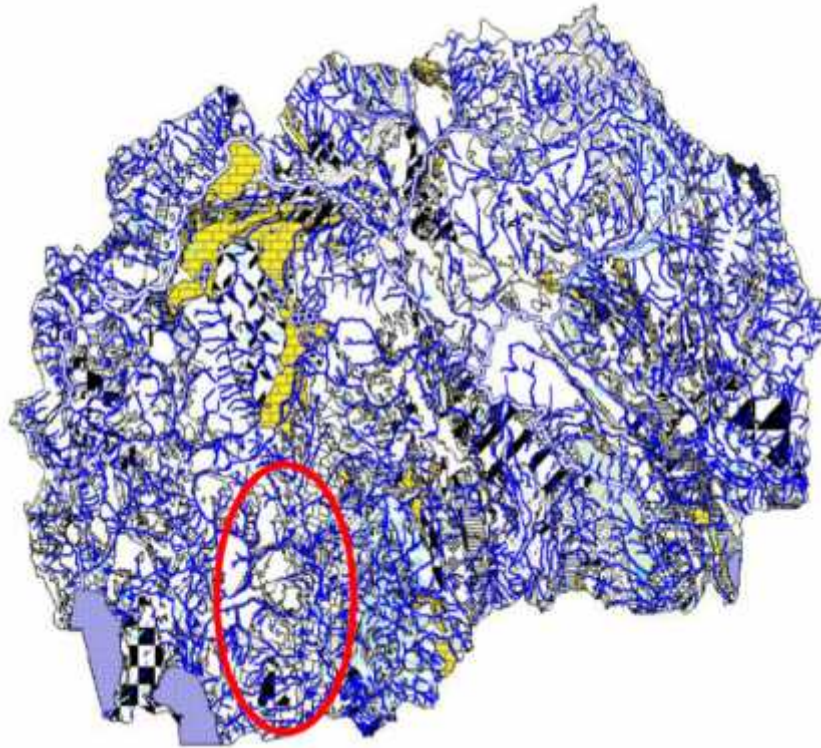


Figure 9 Basic hydro-geological map of the Republic of North Macedonia

Hydrogeological features of this subject section are being categorized by the water resources of the Baba Mountains are composed of numerous springs, steep mountain watercourses and several lakes. The sources of Baba Mountain and other relief structures in the two municipalities appear at the foot of the sapari, at the foot of the rocky sections, on the bare and grassy slopes and elsewhere. In these parts, hundreds of smaller or larger watercourses are shed. The sources of most of the major watercourses reach the high altitude - over 2,200 m. Most are in the form of spring ferns, composed of a network of smaller streams. They are shed in several main branches from which the river itself originates. There are no geothermal springs in the Municipality of Demir Hisar, however there are mineral springs in Smilevo, Pribilci and Mrenoga.

4.4 Basic tectonic and seismic-tectonic features of the terrain

The investigated field according the geo-tectonic regionalization of Republic of North Macedonia represents part of Pelagonija zone as larger geotectonic unit, figure no.17. The Pelagonija zone according its tectonic evolution is instable, due to the complexes of old Paleozoic and Alps structural floor, with already inherited original structure. The Miocene sediments lay discordant over the older formation and have mild monocline fall toward west and south-west. Over these sediments there are Pliocene sediments in horizontal position. They have disjunctive tectonic, but after the faults the youngest effusive rocks erupted.

In correlation with the geological development of the terrain and the geological processes, there are tectonic and seismic-tectonic field properties. Considering that in the largest part the terrain is covered with Neocene sediments and fragmented material, it cannot be noticed some significant tectonic structures (faults, covers etc.).

According the existing Seismologic map of Republic of North Macedonia for a return period of 500 years (recommended for application according Euro code 8 until the creation of national document for application in seismic field), we can conclude that the area along the road is located in regions with intensity I=VIII°MKS (according the scale of Mercali, Cancani and Zieberg).

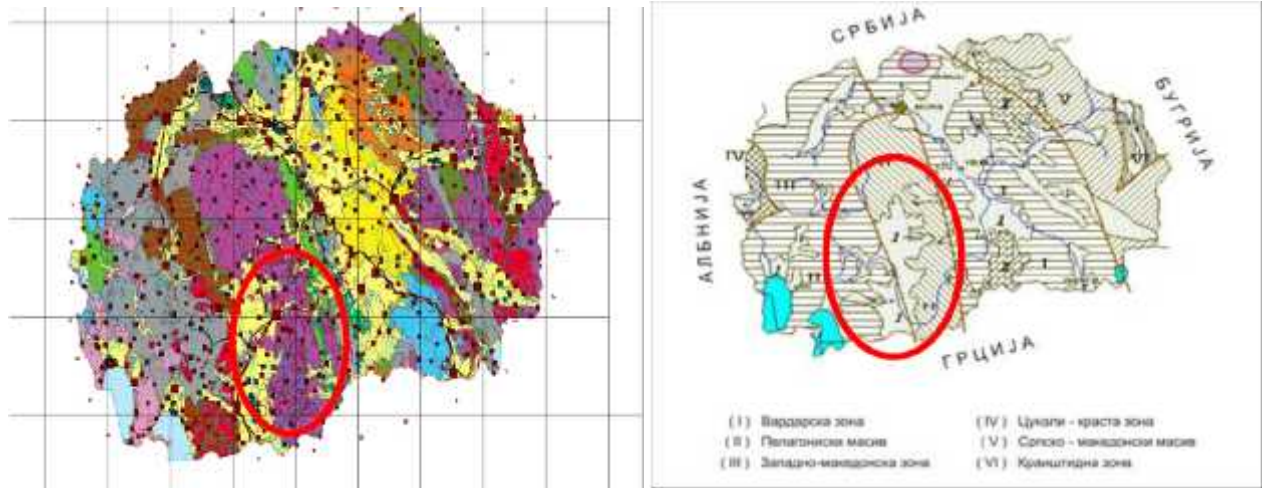


Figure 10 Geotectonic Reonization of the Republic of North Macedonia

4.5 Features of the location

Area is topographically defined territory which is consisted of a mutually dependent characteristic ecosystems that may be or have been the subject of specific human activities. One area type can own fully natural features or to be completely changed by human and does not to cover any natural ecosystem. Through the area is studying the functioning of the relations between human- nature and are defining the reasons for the current look and layout of the ecosystems in the area.

National park Pelister is 15 km from Bitola, 65 km from Ohrid and 30 km from Lake Prespa and covers wider areas that differ in their characteristics from their immediate and distant environment. Its surface is – 12.500 ha with an altitude of 700 to 2,600 m. Pelister National Park is organized in three zones: strictly protected (1500 ha), tourist recreational and amelioration zone.

On the territory of the Municipality of Demir Hisar, which is characterized by dense forests and many mountain rivers, rich flora and fauna, there are many villages and localities rich in ethno-cultural, historical and archeological significance. Eco tourism lovers, rural tourism, hunting, fishing and monastery tourism often include visiting the demir Hisar villages and nature on their agenda when they come to visit Bitola.

Along the route in question, the agricultural land is dominated crossed with rural settlements and local roads. There are also smaller forest stands of the dominant oak community. Among the more important elements are the rural settlements located in the immediate vicinity of the highway.

The area that is subject to analysis in this environmental impact assessment is mainly represented by a flatland with relief valley structures.

4.6 Features of the area (landscape)

Area is topographically defined territory which is consisted of mutually dependent characteristic ecosystems that may be or have been the subject of specific human activities. The area is mainly defined as a piece of land that can be covered by taking a view. One area type can own fully natural features or to be completely changed by human and does not to cover any natural ecosystem. Through the area is studying the functioning of the relations between human-nature and are defining the reasons for the current look and layout of the ecosystems in the area.

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The area that is subject to analysis in this environmental impact assessment is mainly represented by a flatland with relief valley structures.

4.7 Existing water resources

The hydrographic network of the municipalities of Bitola and Demir Hisar consists of the river network with its river flows. The most important river is Crna Reka, which is at the same time the longest right tributary of the river Vardar.

The hydrographic occasions of the municipality Bitola, city of Bitola and its immediate surroundings are conditioned/determined by the geological, geomorphological and climatic characteristics. Through the Bitola the river Dragor runs in a length of 4.5 km. Dragor originates from several small rivers and it is from the Dihovo Dragor whose spring part is made up of several watercourses that spring from the slopes of Pelister. The total length of the river Dragor is 25.123 km with a volume of water reservoirs of 67 km, a basin of 188 km² and a mean decrease of 17.0 %. The amount of water in the river depends exclusively on the precipitation and groundwater of Baba and Pelister. The average flow of Dragor through the city from November to June is 2 - 3 m³/sec.

At 22 km from Bitola lies the artificial accumulation lake "Strezhevo" which is an important hydrographic facility for the municipality of Bitola and Bitola. This lake occupies a volume of 112.000.000 m³ of water, a depth of 72 m, an area of about 7 km², an average width of about 1 km and a length of 7 km. Other hydrographic objects are the pool "Dovledzik", which is a compensation pool with a length of 170 m, width 60 m, volume 13,600 m³ water, depth about 3 m and capacity from 2 – 3.000 baths, "Olympic pool" with dimensions 50x25 m, and one children's pool in both places. On hot summer days, two hydrographic objects are used for bathing and recreation.

Hydromeliorative giant Streshevo was founded in 1978. This system covers all the waters from the Shemnica and Dragor rivers with its tributaries and the watercourses from the Baba Mountain. The dam is built on the river Shemnica (the river cuts the subject section, see Figure 11). Through the main supply duct, the accumulated water is distributed. Streshevo serves to supply Bitola and other populated places with drinking water, supplying industrial water to individual facilities in Bitola, among which REK Bitola. This system serves to irrigate more than 20.200 ha of land in Pelagonia. The Strezhevo system also serves to protect against flooding of a part of Pelagonia.

Through the area of the municipality of Demir Hisar, the upper course of the river "Crna" passes through the central part of the municipality and collects all river flows, thus forming the hydrographic network in the municipality. The river "Crna" has an average annual flow of 15.0 m³/sec. and represents the greatest river potential.

River flows in the municipality are not regulated on the whole length, so in certain places, there is a spill in the time of torrential rainfall. At maximum waters, the course of the river "Crna" and its tributaries spill and flood the agricultural area of 370 ha. The most frequent flooded areas are the areas between the villages of Zhvan and Sopotnica, as well as Graishte and Sveta.

The city water supply is "served" by two wells with a total yield of 40-54 liters / sec (depending on the period of the year), a reservoir area of 1.650 m³ and a water supply network of 32.000 m³. The meliorative area of the Municipality of Demir Hisar is provided with accumulated water from the built reservoir lakes near the villages Suvodol and Strugovo.



Figure 11 Location of Shemnica River

4.8 Climate characteristics of the area and meteorology

The climate in the municipality of Bitola is basically a moderate continental character, with a pronounced continental component, with a dynamic and unstable climate of dry, very hot summer and winter periods divided into shorter, dry and cold.

Temperature has particular characteristics of the continental climate, and precipitation, a drought-edged Mediterranean or steppe climate that, at times, has breakthroughs on hot air masses from North Africa-Sahara.

According to meteorological data, the city has an average annual air temperature of 11.1°C.

The coldest month is January, with an average monthly temperature of 0.6°C, but with an absolute minimum temperature of -30.4°C.

The warmest month is July, with an average monthly temperature of 22.2 and an absolute maximum temperature of 41.2°C.

The absolute annual temperature variation in the air is 71.6°C, which is specific for the continental climate. Spring and autumn months are with pleasant air temperatures, but they can also be specific to prolonged winter or extended summer.

Accordingly, the average annual rainfall is 601 mm with values ranging from 338 mm to 879 mm.

Bitola is also an example with the appearance of polar light. Through the Bitola pass isokhazma (a line that connects places with equal number of days with the appearance of polar light) 0.1, which means that in the sky of Bitola the average only once in 10 years, polar light appears.

In the municipality of Demir Hisar, the influence of the Mediterranean, the moderate continental and the mountainous climate is present. The average air temperature ranges from 8.4°C to 13.5°C for a period of 20 years. Absolute maximum temperatures are in the range of 32.0 and the minimum of -15.0 The amplitudes at the elastic temperatures are quite large and range in the range of 51.5 - 66.6 . The warmest months are July and August and the coldest month is January.

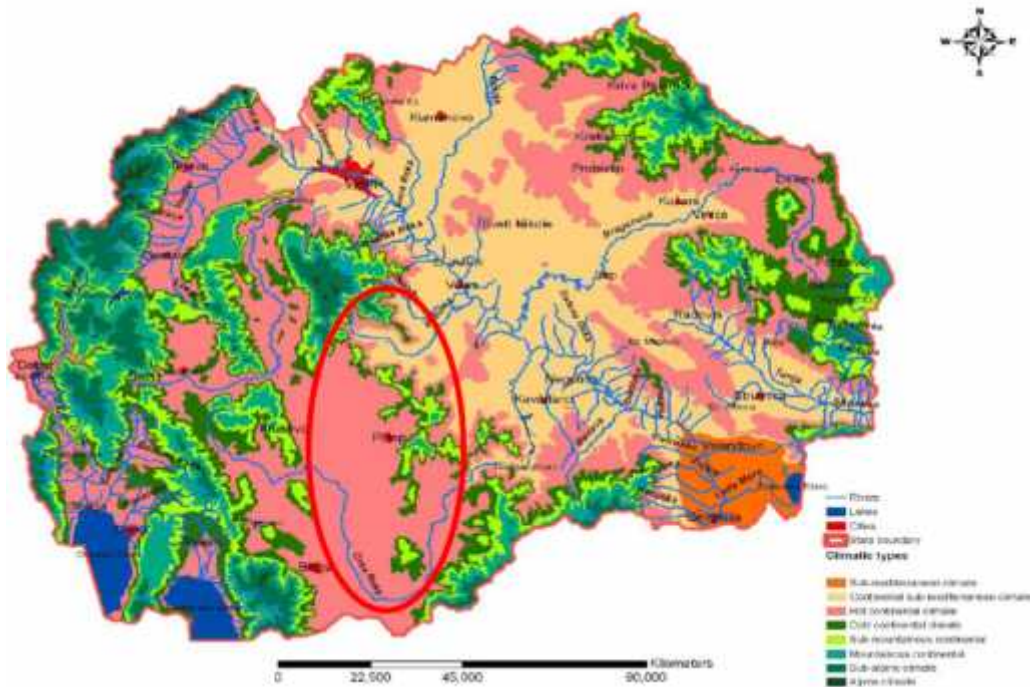


Figure 12 Climate regions in the Republic of North Macedonia

4.9 Biodiversity (flora, fauna and habitats)

Lowlands and fields

Reference to Habitats Directive: No specific reference

Reference Palearctic habitats: 82 agricultural cultures

Main characteristics: lowlands and fields in the area of the road corridor are mainly represented by grasses and crops. Pelagonia Region is the largest contributor to the wheat in the country. Field crops as wheat, barley, oil rapeseed, sunflower, corn grain, corn silage could be found from the both sides of the road corridor. Plantation of monocultures has lower value of biodiversity. Mono-typical structure of community, environmental conditions controlled by man, with the use of large quantities of pesticides and fertilizers, dictate the development of Bio-cenoses with low diversity of species. Unlike the economic importance of the field, their importance for biodiversity is very low. Some fields are divided by hedges composed of different species of bushes and fruit trees, among which the most common are: *Morus spp.*, *Pyrus spp.*, *Populus spp.*, *Robinia pseudoacacia* and *Juglans regia*.

Fungi - some mushrooms are characteristic for different types of agricultural land, such as: *Agaricus hortensis*, *Coprinus spp.*, *Anelaria semiovata*, *Volvariella speciosa* etc.

Mammals - commonly encountered: hedgehog (*Erinaceus concolor*), mole (*Talpa europea*), southern meadows (*Microtus guentheri*), marsh mouse (*Apodemus agrarius*), forest mouse (*Apodemus sylvaticus*), domestic mouse (*Mus domesticus*), marten (*Martes foina*), Macedonian mouse (*Mus macedonicus*), wild hare (*Lepus europeus*), fox (*Vulpes vulpes*), badger (*Meles meles*).

Birds - in these habitats can often find some birds such as: *Melanocorypha calandra*, *Galerida cristata*, *Oenanthe oenanthe*, and many other species are using them for laying.

Reptiles - this habitat is rich in species that are similar similar to that of neighboring habitats.

Orchards

Reference to Habitats Directive: No specific reference

Reference Palearctic habitats: 83.15 Orchards.

Main characteristics: Orchards in road corridor are represented surfaces planted with cherries and plums. Orchards near villages Krklino and Kukurecani and settlements are mainly intended for individual use and trees are of different size and age. The most common types of fruit trees are cherries, plums, almonds and apricots.

Fungi - present similar types as in the lowlands and fields.

Fauna - the composition of fauna in orchards is identical to the one that inhabits all types of agricultural land. More representative species of *Scolytidae* living in forests and bark of cultivated trees in orchards (*Scolytus mali* of apple trees, *S. amygdali* of *Amygdalus communis*, etc.).

Mammals - no characteristic species

Birds - there are not characteristic species, but as the most common are: jay (*Garrulus glandarius*), goldfinch (*Carduelis carduelis*), golden oriole (*Oriolus oriolus*), common starling (*Sturnus vulgaris*) etc.

Reptiles - in this habitat are coming from neighboring habitats and can be found turtles, lizards and snakes.

Amphibians - not typical amphibians.

Invertebrates - from butterflies are represented: *Iphiolides podalirius*, *Pyrgus malvae*, *Aglais io*, *Melanargia galathea*, *Maniola jurtina*, *Pontia edusa*, *Plebeius agestis*, *Melitaea phoebe*, *Erynnis tages*, *Lycaena phleas*, *Pyrgus alveus*, *Vanessa cardui*, *Pieris brassicae*, *P. manni*, *Polyommatus icarus*, and of runners more often are: *Amara aenea*, *Calathus melanocephalus*, *Carabus coriaceus cerisyi*, *Harpalus affinis*, *Harpalus rufipes*, *Harpalus serripes*, *Harpalus tardus* and *Poecilus cupreus*.

Rural settlement (villages)

Reference to Habitats Directive: No specific reference

Reference Palearctic habitats: 84.4 Rural mosaics

Main characteristics: villages along the road corridor are characterized by rural features. As a rule, the houses in these villages Krklino and Kukurecani are surrounded with small gardens and orchards. These conditions allow development of diverse natural vegetation as well as presence of many animals. Besides cultural and ornamental species, vegetation is mainly represented by plants which are in neighboring biotopes such as ruderal plants and weeds.

Mammals - the wealth with vegetables, livestock and poultry makes the village favorable habitat for mammals, as well as for herbivore and carnivore. The most common types are: squirrel (*Sciurus vulgaris*), yellow neck mouse (*Apodemus flavicollis*), wood mouse (*Apodemus sylvaticus*), marsh mouse (*Apodemus agrarius*), plain fluff (*Glis glis*), black rat (*Rattus rattus*), house mouse (*Mus domesticus*), fox (*Vulpes vulpes*), weasels (*Mustela nivalis*, *Mustela putorius*), marten (*Martes foina*), badger (*Meles meles*), wild cat (*Felis sylvestris*).

Birds - there are species that are associated with anthropogenic habitats: *Pica pica*, *Corvus monedula*, *Corvus comix*, *Corvus corax*, *Passer domesticus*, *Passer montanus*, *Ciconia ciconia*, *Falco tinnunculus*, *Columba livia*, *Streptopelia decaocto*, *Tyto alba*, *Otus scops*, *Athene noctua*, *Asio otus*, *Hirundo rustica*, *Hirundo daurica*, *Delichon urbica*, *Sylvia atricapilla*, *Parus caeruleus*, *Parus major*, *Oriolus oriolus* and *Passer hispaniolensis*.

Reptiles and amphibians - rural settlements are favorable habitats for amphibians and reptiles. Small Newt (*Lissotriton vulgaris*), frogs *Rana dalmatina*, *Bombina variegata*, *Bufo bufo*, *Hyla arborea* and *Pelophylax ridibundus*, could be found. From reptiles: turtle

(*Eurotestudo hermanni*), lizards (*Lacerta erhardii*, *Podarcis muralis*, *Lacerta trilineata*, *Lacerta viridis*) and viper (*Vipera ammodytes*) are present.

Invertebrate - this habitat is very favorable habitat for butterflies. Typical and common species: *Lycaena virgaureae*, *L. tityrus*, *Polyommatus belargus*, *P. icarus*, *Leptidea sinapis*, *Plebeius argus*, *Pieris brassicae*, *P. napi*, *Coenonympha pamphilus*, *C. arcania*, *Maniola jurtina*, *Argynnis paphia*, *Satyrium acaciae*, *Colias crocea*, *Arethusana arethusana*, *Nymphalis polychloros*, *Erebia medusa*, *Vanessa cardui*, *V. atalanta*, *Cupido osiris*, *Erynnis tages*, *Polygonia c-album*, *Pseudophilotes vicrama*, *Hamearis lucina*, *Pyrgus alveus*, *Aglais urticae*, *Aporia crategi*. The fauna of the runners is similar to that of agricultural areas (fields, orchards, vineyards). Common types are: *Amara aenea*, *Calathus melanocephalus*, *Calathus fuscipes*, *Microlestes fissuralis*, *Harpalus serripes*, *Harpalus rufipes* and *Poecilus cupreus*.

Bio-corridors

Bio-corridors are linking different parts of a habitat allowing free movement of animals and plants around it. This movement can be an important factor for the survival of many species regarding the changes in the method of land use and climate change. Their function is to preserve the vital ecological relations / interactions by maintaining connectivity between habitats and species populations. Bio-corridors provide daily, periodic and seasonal movements and migrations of various animal species, as well as distribution of plants. The road Bitola-Demir Hisar is not crossing bio-corridor.

Protected areas

As it is shown on next figure there is no national protected area in the project area. Small part of the road is crossing through (proposed) international protected area (International Bird Area - IBA Pelagonia) but the project activities will not be harmful to birds.

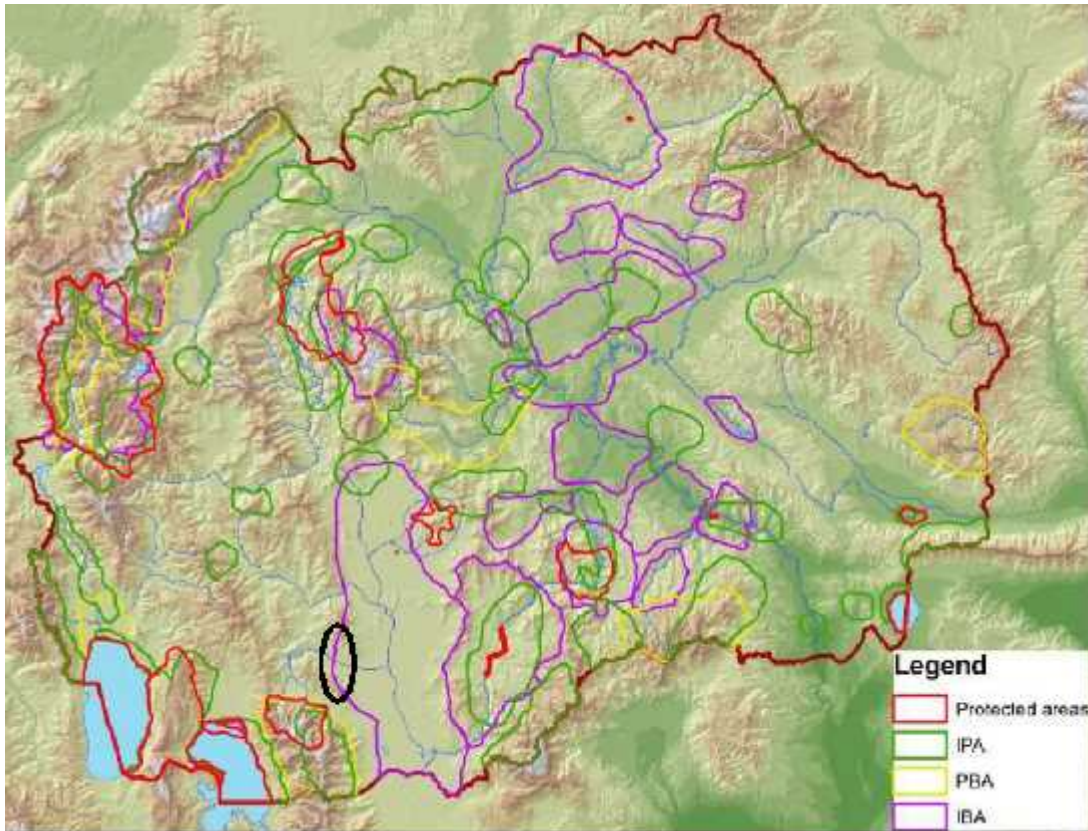


Figure 15 Protected areas (national parks, strict natural reservat and some natural monuments), IBA, IPA, PBA

4.1 Culture H ritage

The municipalities of Bitola and Demir Hisar have rich cultural heritage. In this municipalities there are registered many archaeological sites from Prehistory, Roman, Late Antique and Medieval period.

One of the most recognizable features of the municipality of Bitola are the archaeological sites:

Heraclea Lyncestis, urban settlement from Hellenistic period to Medieval period. It is assumed that the town was founded in the middle IV century by Filip II of Macedon. In the town the following buildings are to be found: antique theatre, basilica A, B, C and D, episcopal palace with early Christian mosaics.



Figure 13 Heraclea Lyncestis, Bitola

Evrejski Grobishta, settlement from Neolithic period

Grgur Tumba, settlement from Neolithic period

Church St. Dimitrija, cathedral church. The church is placed in the center of Bitola and it was built in 1830. The church is in the form of basilica with three naves and with lateral galleries. The belt tower was built in 1836. Today the church serve as cathedral church if the town Bitola.



Figure 14 St. Dimitrija, Bitola

Hajdar Kadi, mosque from Ottoman period. The mosque was built in 1561-1562 by Hajdar Kadi. The architect of the mosque is the famous ottoman architect Mimar Sinan. This mosque was one of the best representation of Ottoman Islamic architecture on the Balkans.



Figure 15 Hajdar Kadi Mosque, Bitola

In the village Krklino there are the following archaeological sites:

- Vrcva, settlement from Medieval period,
- Krklinski livadi-Pod Livagje, settlement from Roman period,
- Padarnica, necropolis from Roman period.

In the village Kukurecani there are the following archaeological sites:

- Kula- Ramnina, church from Medieval period,
- Maglovska Niva, settlement from Neolithic and Roman period,
- Tumba, settlement from Neolithic and Roman period,
- Tumba in the village, settlement from Neolithic period and necropolis from Medieval period.

In the village Dragozani there are following archaeological sites:

- Vakafski Ledinje, church from Medieval period,
- In the village Ledinje, necropolis from Medieval period,
- Gubernica, settlement from Medieval period,
- Dabicki, necropolis from Medieval period,
- Dabje, necropolis from Medieval period,
- Kocista, settlement from Medieval period with church and necropolis,
- Porojnica, settlement from Roman period.

In the village Crnobuki the following archaeological sites are to be found:

- Varvarica, necropolis from Late Antique period,
- Gradiste, fortified settlement from Hellenic and Late Antique period,
- Gulev Rid, settlement from Roman period,
- Under the village, settlement from Roman period,
- Samovilec, fortified settlement from Iron period,
- Tumba, settlement from Neolithic and Eneolithic period.

In the village Lisolaj the following archaeological sites are found:

- Crnobucki Rid, settlement from Roman period.

In the village Lopatica there are following archaeological sites:

- Dolni Leonik, church from Medieval period,

- Kalugjeri, church from Medieval period,
- Kortitnica, necropolis from Roman period,
- Ograda, settlement from Late Antique period.

In Demir Hisar the following site is to be found:

- Grcarnica, fortified refugium from Late Antique period.

4.2 Road infrastructure

The subject section is connection of Corridor Xc Gradsko – Prilep - Bitola (A3e) junction Krklino with direction to the north to connect with new motorway Skopje – Ohrid close to Kicevo and has significant traffic and economic importance for the municipalities connected and for the road network in the Republic of North Macedonia. Subject section is about 20 km long. and passes through one settlement Kukurecani. In settlement Kukurecani there is pedestrian crossings in the school area. Traffic signs for school area are damaged and road markings of these crossings are in poor conditions.



Figure 16 Pedestrian crossing in school area - settlement Kukurecani

Parking should be marked and better organised. Manoeuvring while parking can lead to crashes due to poor parking angles and sight distance, so angled parking should be provided.

Along the analysed section, there is no petrol station but there are multiple rest areas/parking areas and several restaurants.

The existing fence along the section in question is in poor condition and is not maintained and has a negative impact on the safety of the road user. In certain parts, it is covered with greenery. This reduces the visibility of the fence and reduces the functionality of the systems.

4.3 Socio-economic parametars

According to the 2002 census, there are 95,385 inhabitants in the municipality of Bitola.

There are twelve primary municipal schools in the municipality of Bitola. Secondary education in the municipality of Bitola is taking place in seven secondary municipal schools and two private schools.

Faculties operating within the University "St. Kliment Ohridski" – Bitola, Technical faculty - Bitola with dispersed studies in Veles and Prilep.

Population density in the Municipality of Bitola is 788 persons/km². According to the data from the State Statistical Office of the Republic of North Macedonia, the number of population as of 31 December 2012 is 92 905 inhabitants, out of which 45 664 are men and 47 241 are women.

The Municipality of Demir Hisar has 9497 inhabitants in 41 settlements. Leskovo village is completely evicted. In twenty settlements the number of inhabitants is below 100 and in twenty populated places the number of inhabitants is over 100. It is completely settled with. Leskovo, and from a few years ago, without a single inhabitant remained village Cerovo.

Municipality Demir Hisar	NATIONALITY							
	Macedonians	Albanians	Turks	Romani	Vlachs	Serbs	Bosniaks	others
total	9179	232	35	11	7	13	2	18
%	96,65	2,44	0,37	0,12	0,07	0,14	0,02	0,19

The school network is unevenly distributed in the area of the Municipality of Demir Hisar, which can be seen from the situation with active four-year and eight-year schools.

The total number of students from the first to the eighth grade in the academic year 2010/2011 is 647 pupils. The total number of employees in all schools (four-year and primary) in the municipality is 117 (68 in "Goce Delcev", 20 in "Dame Gruev" and 29 in "Brakja Miladinovci").

There is only one secondary municipal school in the Municipality of Demir Hisar, where besides students from the Municipality of Demir Hisar, students from the neighbouring municipalities are also educated. The total number of students from the first to the fourth year in the academic year 2010/2011 is 295 pupils.

4.3.1 Industrial objects

In the territory of the subject section Bitola-Demir Hisar there are no industrial capacities that could be economically affected by the project activities.

5. Environmental impacts

This ESAR has been made in order to locate and determine the existence of potential negative impacts on the environment as a result of the project activities that will proceed with rehabilitation at the road sections between Bitola – Demir Hisar. The rehabilitation of the road sections will be implemented on existing road, where only rehabilitation activities without widening are foreseen. The environmental impacts from this type of project activities appears during all three stages:

- Preparatory phase - preparation of the terrain for the construction phase;
- Constructive phase - rehabilitation of the section;
- Operational phase (the traffic on the route and maintaining the alignment in functional condition, timely removal of all detected irregularities - defects).

After the rehabilitation of the R1305 road section, the specific change in the traffic intensity is not expected. This results in the same operational phase as the current situation. Therefore, environmental management in the preparation and rehabilitation phase is the main content of this ESAR.

Preparatory phase – it includes all preparatory activities before the start of the activities for rehabilitation of the subject section. The preparatory phase has a short duration with preparation of the terrain for the constructive phase. This phase is limited in duration and depends on the dynamic plan for execution of construction activities, and at the same time it depends on weather conditions and terrain configuration. Also, during this phase, the initial measures for protection of the environment will be undertaken: organizing of movement and work of construction machinery, as well as placing appropriate containers for waste collection.

In the preparatory and constructive phase i.e. during rehabilitation of the sections between Bitola – Demir Hisar are expected following emissions:

1. Impacts on the air: fugitive dust emission from cleaning of greenery (trees and shrubs) on both road sides and cleaning of the culverts, ditches, gutters; fugitive dust emissions from construction activities during loading and unloading of the earth material and demolition wastes, processes of roughing of the pavement/demolition (removal of a layer from the pavement construction) and removal of the existing asphalt layer, exhaust gases from construction machinery and transport vehicles, fugitive emissions of volatile organic compounds;
2. Impacts on water: communal waste water produced by construction workers and storm waste water, eventually leakage of fuel, oil and lubricants and contaminating soil and groundwater, and if wastes are not managed appropriately, they could also contaminate the soil and groundwater;

3. Impacts on environment from waste production: organic biodegradable waste and earth from cleaning of the terrain, communal waste and construction and demolition waste, eventually contaminated soil and groundwater from fuel, oil and lubricants in case of accidents and leakage;
4. Impacts on the soil: from waste water and wastes (if not managed appropriately), and from hazardous substances if accidents and leakage of fuel, oil and lubricants occur;
5. Impacts from noise, vibration and non-ionizing radiation: noise and vibration from the operation of construction machinery;
6. Impacts on biodiversity (flora and fauna) - impact on biodiversity (disturbance of fauna).

In the phase of exploitation of the section or in the operational phase are expected following emissions:

1. Impacts on the air - emissions from mobile sources of pollution (vehicles);
2. Impacts on the water and soil - storm waste water;
3. Impacts from noise, vibrations and non-ionizing radiation - noise and vibrations from the work of the vehicles.

5.1 Air emissions

The following environmental impacts are expected during the preparatory phase:

- Occurrence of fugitive dust emission from the clearing of the terrain (greenery (trees and shrubs) on both road sides);
- Exhaust gases from construction machinery and transport vehicles;

Constactive phase is the phase in which the rehabilitation activities will be performed. The following environmental impacts are expected during this phase:

- Occurrence of fugitive dust emission during loading and unloading of the earth material and demolition wastes, processes of roughing of the pavement/demolition (removal of a layer from the pavement construction) and removal of the existing asphalt layer;
- During the application of the bitumen and asphalt emulsions will occur fugitive emissions of volatile organic compounds;
- Emission of exhaust gasses from the construction machinery and transport vehicles;

In the phase of exploitation of the section, the operational phase, the following environmental impacts are expected:

- Gases emissions from mobile sources of pollution (vehicles).

Increased emissions into the air will occur during the preparatory and constructive phase of the project due to the work of construction machinery and trucks, cleaning of the terrain (trees and shrubs) and cleaning of the culverts, ditches, gutters as well as the processes of rehabilitation - roughing of the pavement or demolition and removal of the existing asphalt layer, and constructing of the new bitumen and asphalt – concrete layers. The exhaust gases emitted as a result of combustion of fuels in the construction machinery and trucks are usually composed of the following pollutants: SO₂, NO_x, CO, PM₁₀, not combusted hydrocarbons, benzene and other aromatic hydrocarbons. The quantities of the exhaust gases and the type of pollutants will depend on the quality of the used fuel, condition in which the trucks and constructive machinery are, as well as the duration of their activity.

Gasses and pollutants are emitted in the ambient air through the system for disposal of waste gases, from vehicles and construction machinery on-site. The quantity and composition of exhaust gases depends on several parameters such as the type and age of vehicle, the performance of vehicle, the type of used fuel, features of the fuel in the distribution network, the presence of additives, the degree of combustion of fuel, etc.

SO₂, CO₂, H₂O and aromatic hydrocarbons occur during the complete combustion of fuel, while Pb₂O₃, etc. occur when using catalysts. CO, hydrocarbons, suspended dust, etc. occur during the incomplete combustion of fuel.

During a long-term exposure to these toxic substances, they have negative effect on the human health. The geomorphological and weather conditions have influence on the concentration of emitted pollutants in the air i.e. the pollution of the ambient air in the region.

The following table presents the limit values for the pollutants from construction machines, in accordance with the Directive 97/68/EC:

Table 1 Limit values for pollutants emitted by the construction machinery (Directive 97/68/EC)

Motor power	CO (g/kWh)	HC (g/kWh)	NOx (g/kWh)	PT (PM) (g/kWh)
130 P 560	5.0	1.3	9.2	0.54
75 P 130	5.0	1.3	9.2	0.7
37 P 75	6.5	1.3	9.2	0.85

During the rehabilitation of the road section, dust emitted from the mechanical operation of construction machinery and combustion of fuel affects the nearby and distant environment will depend on the size (aerodynamic diameter of the particles) and the weather conditions. The impact of the fugitive dust emission will be additionally intensified by the emission of exhaust gasses from the construction machinery.

The fine dust, i.e. inhalable particles with diameter D 2.5µm that are created during combustion of fuel in motor vehicles are transferred at a greater distance and have a chemical composition, i.e. contain organic compounds and heavy metals, which has negative impact on the human health and the environment.

The following table presents the limits and margin of tolerance for suspended dust with a diameter of 10 micrometers PM₁₀ and 2,5 micrometers PM_{2,5}, according to the Regulation on limit values for levels and types of pollutants in ambient air and alert thresholds, deadlines for achieving the limit values, margins of tolerance the limit value, target values and long-term goals (“Official Gazette of RM” No. 50/05).

Table 2 Limits and margin of tolerance for suspended dust PM₁₀ and PM_{2,5}

Pollutant substance	Average period	Limit values	Allowed number of exceeding during the year
PM₁₀	24 hours	50 µg/m ³	35
	1 year	40 µg/m ³	0
PM_{2,5}	1 year	25 µg/m ³	0

The fugitive emission of volatile organic components (VOC) from the use of bitumenous emulsion and asphalt mixture will have less influence, because these compounds are easily evaporative and retain shortly in the air.

All emissions into the air will be locally and timely limited. Considering the configuration of the terrain large dispersion of the pollutants is not expected. Since the air quality in the area where rehabilitation activities will take place is good, if the recommendations from the Environmental Management Plan (EMP) are implemented, significant impacts from emissions into the air in the preparatory and constructive phase are not expected.

During the exploitation of the road emissions into the air will be caused by exhaust gases from the vehicles that will use the road. The composition of the exhaust gases will be similar to those emitted in the constructive phase: SO₂, NO_x, CO, PM₁₀, not combusted hydrocarbons, benzene and polynuclear aromatic hydrocarbons (PAHs). The composition and the quantities will depend on the type of fuels and technical correctness of the vehicles that will be using the road. Taking into account that increasing of the traffic intensity is not expected, emissions into the air from the operational phase are considered to be the same as the current ones.

5.2 Water pollution

The pollution of the waters during the rehabilitation of the section can be physical, chemical and biological.

The physical pollution is demonstrated by the presence of solid particles from residues of earth, sand, solid particles from the friction of the tyres, residues from disasters, etc. The physical pollution from liquid material means presence of grease and oils. The solid particles are deposited in the gutters and in the drain canals after being washed off from the road surface whereby they may clog them, while the grease and the oils swim on the surface and reach the recipient. Then they create a film, which stops the supply of oxygen in the watercourse, which inhibits the normal development of the bio-world in the recipient.

The chemical pollution is a result of the dilution of the pollutants present in the air. These pollutants come from the exhaust gases from the construction machinery and vehicles. The chemical pollution may be demonstrated as strongly acidic, weakly acidic, neutral medium and all the variations from strongly alkaline to strongly acidic medium.

Biological pollution is a consequence to the disintegration of organic material that serves as food to different microorganisms. They can be a result from food waste by unconscientious traffic participants, of leaves scattered by the wind and other biodegradable wastes, feathers or other material present in the close surroundings.

Mechanical impurities caused from the washing of the ground by heavy rain and the flow of surface waters will cause filling of the beds and blurriness of waters, which will decrease the penetration of light in the greater depths and change the living conditions in the aquifer. The change of quality of the superficial and groundwaters may influence the usual utilisation of the water for different purposes by the population and the industrial capacities.

The most dangerous pollutants of the surface and ground waters are the organic material components difficult to degrade and the harmful metals.

Camps for workers and places for maintenance and cleaning of the mechanization are potential polluters, through production of fecal waste water, solid waste and non proper maintenance and cleaning of the mechanization.

When carrying out the construction activities, it is possible for the emission of waste storm water and insignificant quantity of sanitary water that will be produced by the employees in the maintenance of hygiene.

During the construction activities, the employees will produce waste water while maintaining the hygiene (hand washing) and refreshment in the summer period. The amount of wastewater to be produced is minimal.

Pollution of groundwater may occur in case of accidents. All these possible negative impacts that may occur during the rehabilitation of the section will be minimized for all measures that will be adequately envisaged in the Monitoring Plan as an integral part of the project documentation for the realization of the project.

The road section Bitola-Demir Hisar cuts the river Shemnica which flows from Baba Mountain. Shemnica is the most important tributary of Crna Reka in the southern part of Pelagonija. It has built a Strezhevo lake that irrigates fertile agricultural areas and provides technical water for REK Bitola.

In the lower part of its course, Shemnica irrigates the fertile soil on the field between Bitola, Novaci and Mogila.

To avoid water pollution, recommendations given in EMP should be followed.

5.3 Waste generation

Waste management is one of the most serious environmental problems in the country. Regular service for collecting waste is limited to urban areas, while very little attention is paid to rural settlements, 70% of the total urban population receives regular service for collecting waste, while only 20% of the population in rural areas is covered by service.

Municipal waste management is fully in the competence of the local self-government; it is directly related to the planning documents for the use of the local land and should be in accordance with the national strategic documents - the National Waste Management Plan and the National Waste Management Strategy and other documents that plan its management.

Proper waste management according to the generally accepted international norms will reduce the waste impact on soil (through uncontrolled waste dumping), groundwater (directly contaminated over time from uncontrolled waste disposal) and air (through waste burning on open air). In case of accidents and leakage the upper soil layer can be contaminated with fuel, oil and lubricants, which will present hazardous waste, and if managed appropriately will not contaminate soil and groundwater.

Public Communal Enterprise (PCE) "Komunalec" – Bitola is responsible for the collection and disposal of municipal waste for the settlements in municipality of Bitola and PCE "Komunalec" – Demir Hisar is responsible for collection and disposal of municipal waste for the settlements in municipality of Demir Hisar.

Preparatory and Constructive phase

Biodegradable waste (debris from branches, leaves, roots, etc.) will be produced during the preparation activities. This type of waste should not end in the water flows, because its decay would cause eutrophication of the water of nearby Shemnica River.

During the preparatory and rehabilitation phase of the road section mixed municipal waste will be generated from the workers. In the process of rehabilitation of the road section from Bitola to Demir Hisar, mixed municipal waste from the employees and waste as a result of construction activities, will be generated. The construction waste in this case is inert waste, unless bituminous substances containing tar occur; it will be generated also biodegradable waste; hazardous waste.

Inert waste is consisted of soil, stones, asphalt, concrete etc. Inert waste does not cause chemical contamination of the environment, but has impact on the landscape.

Hazardous waste will be consisted mainly of petroleum products, lubricants and oils for the vehicle and construction machinery, bituminous substances containing tar, as well as used packages of these substances. Hazardous waste, if not properly handled and landfilled, causes pollution to all environmental media, especially to soil, water and groundwater, and has toxic effects on the wildlife.

Solid and liquid waste produced by the workers will be consisted by biodegradable waste from food, plastics, paper, glass, metal, and fecal matter. If this type of waste is not properly managed, it will cause pollution and negative visual impact to the site.

Waste generators shall, to the greatest extent possible, to avoid waste generation and reduce the harmful effects of waste on the environment, human life and health.

Operational Phase

The operational phase of the road may generate waste that will occur as a result of cleaning of the culverts (earth, stones, organic waste, etc.) as well as waste from maintenance of road in good condition-filling holes etc. if needed. Producing of solid waste at this stage may occur from people who will traffic the road, and it will be solid municipal waste. All possible type of waste in this phase present current condition, and according to that, there are not expected changes in waste generation, and, consequently, the wastes from this phase are not taken into account when we are talking about waste generation and its impact on media.

The next table shows the types of wastes and quantities that will be generated during preparatory and constructive phase and how they will be managed.

Table 3 Types of waste and quantities

Phase	Ordinal number	Waste type	No. from the List of types of waste ("Official Gazette of RM" No. 100/2005)	Waste quantity on annual level expressed in tones and litres	Manner of waste treatment (processing, storage, transferring, removal, etc.)	Name of the legal entity that treats the waste and location where the waste shall be disposed of (landfill)
Preparatory and constructive phase	1	Mixed communal waste	20 03 01	Cannot be determined ²	Temporary disposal in PVC bags up its removal in containers in the immediate vicinity	PCE of the responsible municipality
	2	Organic waste	20 02 01	N/A	Depending on quantity to be landfilled or it can be used for composting according to the strategies of the municipalities of Bitola and Demir Hisar	PCE of the responsible municipality
	3	Polluted soil from possible	17 05 05*	N/A	To manage with the polluted soil as with	Company that posses

² The quantity of produced communal waste will depend on the number of the executors of the construction works during the restoration, the time period of construction and the time needed for the realization of the project

		fuel, oil and lubricants leakage from the mechanisation			hazardous waste (immediately to remove contaminated soil, to stored it separately as hazardous waste and to handed over to a company that posses a Licence for collection and transportation of hazardous waste according to Law on waste management)	an appropriate Licence according to Law on waste management
	4	Inert waste-demolition waste (asphalt waste from scratching)	17 03 02	N/A	Reuse in agreement with the PCE	PCE of the responsible municipality

*Hazardous waste according to the List of waste types ("Official Gazette of RM" No. 100/05)

For managing the different type of wastes it is necessary to be signed Contract with licenced companies for specific waste management according to the National Law on waste management.

5.4 Soil contamination

Impacts on soil during the process of rehabilitation of the road section Bitola – Demir Hisar are expected to be insignificant, because expanding of the subject section is not foreseen and it is an existing road on which in the past intensive traffic took place.

The effects on the soil caused by the traffic in the course of the section are caused by some degradation, as well as: salination, reduction of the content of organic material, loss of soil biodiversity, etc.

Preparatory and Constructive phase

Such impacts on the quality of the soil during the preparatory phase and rehabilitation of the road, resulting from preparatory activities and construction activities can be expecting from:

- Non appropriate management with wastewater and wastes;
- Leakage of fuels, oils and lubricants from construction machinery, which, in addition to affecting the soil, by their spillover and filtering through the soil, results in pollution of groundwater.

In case of oil leakage from the construction machinery, it is necessary to act in accordance with the Law on Waste Management ("Official Gazette of RM" No. 68/04, 71/04, 107/07, 102/08, 143/08, 124/10, 09/11, 123/12 and 163/13), i.e. it is necessary to dig the

contaminated soil and treat it like hazardous waste and take all necessary measures to prevent such a leak or when it is not possible to limit environmental impact.

Operational phase

Major impacts on soil are not expected during the exploitation of the road. Impacts on the soil in this phase will occur from the exhaust gases from the vehicle, which will traffic the road, as well as from the residues from gasoline, oil and lubricants. These impacts are directly conditioned by the number of vehicles, which will traffic the road, technical conditions of the vehicle, as well as the quality of used fuels. Pollution of groundwater and soil can occur in case of accidents and emergencies.

5.5 Noise, vibration and non-ionizing radiation

Under the Law on Noise Protection in the Environment (“Official Gazette of RM” No. 79/07 and 163/13) environmental noise can be caused by unwanted or harmful outdoor sound created by human activities and which is imposed by the nearby environment and causes discomfort and harassment, including noise emitted by means of transport, road, rail and air traffic.

Noise and vibrations that will occur during the rehabilitation of the section appears as a result of the operation of construction machinery that will be engaged during the preparatory and construction phase.

In the preparatory and construction phase, during the clearing of the terrain and during the process of rehabilitation of the road section Bitola – Demir Hisar, the maximum allowable noise levels will be exceeded. Construction machinery and vehicles causing noise intensity (depending on the scope and duration of construction activities) around 85 dB at the source, while the dispersion of the sound depends on weather conditions (wind speed, humidity, air pressure), morphology, absorption powers of vegetation and other factors whose differences contribute to difficulties predicting the intensity of noise at various distances from the source of noise.

Meteorological conditions have a major impact on the intensity of noise and vibration. On vibrations affect the direction and speed of wind, while of the spread of sound affect wind speed and temperature as a function of height and terrain configuration. The wind seems to increase the intensity of the sound, that is almost always in the direction of the wind. The influence of wind on the intensity of noise is greatest in winter period.

For the impact of noise on the environment, the location of the Bitola – Demir Hisar section and the distance from the nearest receptors - habitats, etc., is of crucial importance.

The limit values for the basic indicators of environmental noise are set out in the Rulebook of noise levels (“Official Gazette of RM” No. 147/08).

Given that it is an already existing road, the noise emitted during the execution of the overhauled construction activities for the rehabilitation of the same, will not significantly affect the surrounding population. During the implementation of the activities, vibrations will occur, primarily caused by the movement of the construction and transport machinery, but they will be of temporary character, and locally in the immediate vicinity of the route planned for the construction activities.

The type of sources that produce noise, vibration and non-ionizing radiation with information about their intensity are given in the following table:

Table 4 List of sources of noise, vibration and non-ionizing radiation

Source of emission	Type of emission (noise, vibration or non-ionizing radiation)	Equipment - device with a description of the maximum power	Emitted noise intensity (dB) expressed through index value of the equipment	Intensity of vibrations and non-ionizing emitted radiation	Emission periods (number of hours per day)
Heavy vehicles (construction machinery)	Noise	Bulldozer, excavator, trucks for material transportation	85 dB	/	8

The noise intensity and its impact on the environment depend on the scope and duration of the activities.

The limit values for the basic indicators of noise in environment are defined with the Rulebook for limit values of the noise level (“Official Gazette of RM” No. 147/08). According to the degree of protection from noise, the limit values for the basic indicators of noise in environment caused by different sources should not be higher than:

Table 5 Noise level per area

Area differentiated by the degree of noise protection	Noise level expressed in dB (A)		
	Ld	Lv	Ln
Area of first degree	50	50	40
Area of second degree	55	55	45
Area of third degree	60	60	55
Area of fourth degree	70	70	60

Legend:

- Ld - day (period from 07:00 h to 19:00 h),
- Lv - evening (period from 19:00 h to 23:00 h),

- Ln - night (period from 23:00 h to 07:00 h).

The areas according to the degree of noise protection are defined in the Rulebook for locations of measurement stations and measuring points ("Official Gazette of RM" No. 120/08).

- Area of I degree of noise protection is area intended for tourism and recreation, area nearby hospitals, areas of national parks and natural reserves.
- Area of II degree of noise protection is area that is primarily intended for residence, i.e. residential region, area nearby buildings designed for educational activity, facilities for social protection intended for accommodation of children and elder persons, facilities for primary health protection, area of playgrounds and public parks, area of public greenery spaces and recreational area, areas of local parks.
- Area of III degree of noise protection is area where activities in the surroundings are allowed and the causing of noise is less considered: trade–business–residential area, which is also designed for accommodation, i.e. area with buildings that have protected spaces, crafts and related production activities (mixed area), area designed for agriculture activities and public centers for administrative, commercial, service and catering activities.
- Area of IV degree of noise protection is area where activities in the surroundings are allowed, which can cause interference with noise, area without apartments, designed for industrial and crafts or other similar production activities, transport activities, storage activities, service and communal activities that are causing bigger noise.

According to data from the literature and comparative analysis it is concluded that the level of noise in the construction phase will exceed the limit values of noise and will cause a negative impact on the environment. The intensity of the noise and its impact on the environment will depend on the scope and duration of construction activities.

Subject road section belongs to area of III degree of noise protection, which is area where activities in the surroundings are allowed and the causing of noise is less considered: trade–business–residential area, which is also designed for accommodation, i.e. area with buildings that have protected spaces, crafts and related production activities (mixed area), area designed for agriculture activities and public centers for administrative, commercial, service and catering activities.

During the exploitation of the road, the noise will be produced by the vehicle, which will traffic the road. Considering that increasing of traffic intensity is not expected, and abrasion between wheels and pavement will decrease, decreasing of noise level during the operational phase are expected.

5.6 Biodiversity (flora and fauna)

With the implementation of the planned project activities along the section some impacts on the surrounding flora and fauna will occur. These impacts are expected to occur in the preparatory, constructive and operational phase.

At preparatory phase, during the activities for preparation of the terrain and its proper clearing, there will be no destruction of the vegetation belt that currently exists in the immediate vicinity of the road (most of the habitats are agricultural land). Due to the use of construction machinery in preparatory and constructive phase, increased intensity of noise and vibration and increased amounts of emitted exhaust gases are expected, as well as emission of dust, that will cause impact on the surrounding flora and fauna but with measures for protection, monitoring plan within the plan for environmental protection prepared by the contractor, on the basis of project documentation, these impacts will be minimized.

Noise, vibrations and exhaust emissions from driving fuels are impacts that will certainly occur in the operational phase. But it is important to mention that the impacts that are expected during the operational phase are already present and occur during the use of the subject section. No protected area is detected along the road section and no bio corridor is crossed.

To mitigate indirect impacts (air, soil and noise pollution, waste management etc.), recommendations given in EMP should be implemented.

5.7 Cultural heritage impacts

On subject sections on the road and their immediate surroundings there are not significant monument of culture that could be affected by the project activities. The planned project activities along the section will not occur some impacts on the surrounding cultural heritage.

However, during the preparatory, constructive and operational phase are expected to occur some minor impacts. At preparatory phase, during the activities for preparation of the terrain and its proper clearing, there will be no destruction of the cultural heritage. Due to the use of construction machinery in preparatory and constructive phase, increased intensity of noise and vibration are expected, that can cause minor impact on the surrounding cultural heritage, but with measures for protection, monitoring plan within the plan for environmental protection prepared by the contractor, on the basis of project documentation, these impacts will be minimized.

Noise, vibrations and exhaust emissions from driving fuels are impacts that will certainly occur in the operational phase. But it is important to mention that the impacts that are expected during the operational phase are already present and occur during the use of the subject section. To mitigate indirect impacts (air, soil and noise pollution, waste management etc.), recommendations given in EMP should be implemented.

The rehabilitation activities will be implemented on existing road, where only rehabilitation activities without widening are foreseen. Consequently, the project activities will not have impact on the nearby cultural heritage.

5.8 Socio-Economic impacts

The estimated road for rehabilitation starts from the city of Bitola, passes through village Kukurecani and ends in the city of Demir Hisar. Foreseen construction activities for the rehabilitation will be limited only along the section Bitola – Demir Hisar, and there are not foreseen activities that will cause changes directly related to settlements (intercession of agricultural land conversion), which were to change the lifestyle of the local population and to create significant demographic changes and impacts.

Socio - economic aspect over the rehabilitation process will not cause negative impacts, due to the fact that the project is related to the rehabilitation within the existing dimensions of the road. Expansion of the section is not anticipated, so there will be no demolition activities along the route, as well as conversion of agricultural land and changes in the landscape. It is important to have in mind that there is no need for land acquisition or displacement of any structure.

Positive socio-economic effects are expected after the implementation of construction activities and commissioning of the section which will be upgraded and rehabilitated.

The project has a positive impact on the society, especially in the part of the economic life of the community and environment. The rehabilitation of the road will enable faster and more secure access to all places in the municipality which will positively affect on the transport sector, agriculture and on the other economic sectors that are developing and on which is based the future economic development of the municipality. Improvement of the road conditions will most probably increase the speed of the vehicles. In that context is very useful to mention the need to emphasize the safety issues (i.e. traffic conditions will be improved and traffic safety will be increased).

The rehabilitated road will allow residents major access to the local services such as health care, educational institutions, social work centers which cover the area of the municipality of Bitola and Demir Hisar.

The involvement and continuous interaction with different stakeholder groups is crucial to increase acceptance of the planned measures and for their successful implementation. The public were invited to participate in the process of production of key elements of documentation for this project. The aim of the process of consultation is to inform the public about the planned rehabilitation and to collect the feedback from the representatives of local self-government, inhabitants and especially stakeholders (their needs, perceptions and opinions related to the project).

Public and especially stakeholders will be able to use the grievance procedure. All the information regarding the grievance procedure will be widely disseminated to affected municipality and affected local government.

PESR is truly committed to receiving and responding to all comments or complains, either verbally or in writing in relation to the Project. PESR recognizes that consultation is an ongoing process and different concerns may arise as the project moves into construction phase. All comments and complaints will be forwarded and processed by the responsible person of the PESR services:

Mrs Sashka Bogdanovska Ajceva

Tel: + 389 (0) 78 330 297

e-mail: saska@roads.org.mk

Address: Public Enterprise for State Roads

Dame Gruev 14, 1000 Skopje, Republic of North Macedonia

Web: www.roads.org.mk

The response time for grievances will be in accordance with national legislation for this subject. Comments on the Project, and complaints, can also be submitted to the responsible contact person of the municipality of Bitola and Demir Hisar:

Municipality of Bitola

Tel: + 389 47 208 442

E-mail: www.bitola.gov.mk

7000 Bitola

Republic of North Macedonia

Municipality of Demir Hisar

Tel: +389 47 552 661

E-mail: www.demirhisar.gov.mk

7240 Demir Hisar

Republic of North Macedonia

It is recommended that all grievances should be processed by a Commission which would be composed of at least three persons: representatives of the Investor (PESR), local self-

government and the local population. The names and contact information of the authorized persons from PESR and the municipality should be also indicated on the boards which are posted before the beginning of the construction activities. The inhabitants of Bitola and Demir Hisar are recommended to elect a person in charge of the grievances on the side of their village. The local inhabitants will be able to submit their comments and complaints to that appointed person. Being a part of the Commission, that person would be also to inform on the course of the grievance procedure.

Contact details of the contractor's project office will also be made publically-available, one known. In addition to this document, the main formal bases for submission of comments and complaints directly or indirectly relating to the project are also established.

Other complaints regarding the environmental impact and the social environment will be entered in the complaints record.

The Grievance Form (in North Macedonian and English) will be made available on the web site www.roads.org.mk and all the concerned municipalities will receive pre-printed forms to be readily-available for the public. A worker's Grievance Mechanism will also be established for the employees of construction companies (as a separate system).

PESR will monitor the entire process of comments and complaints and the information will be transposed in the corresponding reports, which will be prepared and posted on its website. PESR is obliged to respond to all complaints according to procedures prescribed in national legislation.

In their complaints, the stakeholders may use legal assistance provided by the North Macedonian legislation.

6. Environmental and Social Management and Monitoring Plan (ESMMP)

The main mitigation activities are described in Environment and Social Management and Monitoring Plan (ESMMP) given in Table 6 and Table 7.

Environment and Social Management and Monitoring Plan (ESMMP) identifies the environmental impacts during preparatory and construction - rehabilitation phase, mitigation measures and responsibilities for implementation of mitigation measures.

Mitigation is an integral part of impact evaluation. It looks the better ways of taking actions so that the negative impacts are eliminated or minimized.

Table 6 Environment and Social Management Plan

Phase	Issue	Mitigation measures	Responsibility	Comments	Indicative costs (euros)
Preparation	<i>Traffic safety</i>	<ul style="list-style-type: none"> - Information to the public about rehabilitation activities, - Procedure for providing adequate information road signs. 	Contractor	/	1.000€
Preparation	<i>Health and safety</i>	<ul style="list-style-type: none"> - Setting mobile toilets along the route and signing a contract with an authorized company. 	Contractor	/	300€
Rehabilitation	<i>Traffic safety</i> Traffic Mangement, Placement of traffic signs	<ul style="list-style-type: none"> - Providing adequate signalization, - Traffic safety signs, - Flag persons for traffic control. 	Contractor	Traffic management plan shall be prepared by the Contractor and approved by Ministry of Interior affairs.	2.000€
Rehabilitation	<i>Occupational Health and Safety</i>	<ul style="list-style-type: none"> - Separate Occupational Health and Safety Plan for temporary construction mobile sites, which contains appropriate measures for occupational health and safety is prepared, revised and adopted. The measures from this OHS Plan will be implemented during rehabilitation phase. 	Contractor	Appoint an Environmental and Health and Safety Manager	3.000€
Rehabilitation	<i>Air pollution</i> Fugitive emission of dust, emission of exhaust gases from construction mechanization	<ul style="list-style-type: none"> - Use of standardized fuels for mechanization, - Minimising emissions through regular spraying with water during the construction works, - Using technically correct machinery, - Route planning and factor of loading and unloading to reduce of fuel consumption and emissions of exhauste gases and fugitive dust emissions, 	Contractor	/	2.000€

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		<ul style="list-style-type: none"> - Avoid working on machinery in so called "idle", turn off mechanization when is not necessary, - Covering vehicles that transport solid material, - Implementation of Traffic Management Plan. 			
Rehabilitation	Potential pollution of <i>soil and groundwater</i> contamination of surface water	<ul style="list-style-type: none"> - Provide minimal size of work site, - Termination of construction activities in case of uncontrolled spills of fuel, oil, lubricants and other chemicals, sprinkle with sand and removal of polluted soil layer. Polluted soil layer would be treated as a hazardous waste, - Placing mobile toilets on certain places along the section and contracting with the company which will undertake and clean them, - Washing of the construction mechanization to be done on proper location, - Proper handling of lubricants, oil, fuel. 	Contractor	/	1.500€
Rehabilitation	<i>Waste generation</i> (communal waste from engaged employees, demolition waste etc.)	<ul style="list-style-type: none"> - Implementation of key principles for sustainable waste management, - Separation of different types of waste, - Placement of appropriate containers for collection of municipal waste on location, - Handling waste to authorized legal/physical entities, and Contracting with authorized companies for collecting and 	Contractor	Contract with authorized legal/physical entities.	3.500€

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		<p>further management of different types of waste according to the Law on waste management,</p> <ul style="list-style-type: none"> - Develop Waste Management Plan, - The demolition waste (asphalt) to be reused, in accordance with the PCE needs, - Hazardous waste to be undertaken by the authorized company for hazardous waste management, - Waste produced by the workers (municipal waste) to be handed over to the appropriate PCE in the municipality (Bitola and Demir Hisar), which is authorized enterprise for communal waste management. 			
Rehabilitation	<i>Noise and vibrations</i> from construction activities	<ul style="list-style-type: none"> - Limit activities to daylight working hours from 8 am-5 pm, - Planning the construction procedures due to minimizing emitted noise (in time and intensity), - Turning off the engines of vehicles and construction machinery when they are not in use, - Information for the local population about the project activities. 	Contractor	Control of technical features of the construction mechanization.	800€
Rehabilitation	<i>Biodiversity</i>	<ul style="list-style-type: none"> - Provide minimal size of work site, - Minimal removal of the vegetation alongside the section during the preparation activities, - Temporary waste disposal sites along the route not to be created, 	Contractor	/	1.000€

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		<ul style="list-style-type: none"> - On the river bed in vicinity of the section any kind of material disposal (construction material, waste etc.) and placement of temporary objects is forbidden, - Hunting and fishing, collecting forest berries, bird eggs etc, by the workers is not allowed. 			
Rehabilitation	Cultural heritage	<ul style="list-style-type: none"> - Provide minimal size of work site, - Minimal removal of the earth alongside the section during the preparation activities. 	Contractor	/	1.000€
Rehabilitation	<i>Material transport</i>	<ul style="list-style-type: none"> - Cover truck load, - Trucks shall be covered to minimize dust and material spillage, - Impementation of Traffic Management plan. 	Contractor	/	1.500€
Rehabilitation	<i>Construction site</i> Noise disturbance to population and employees	<ul style="list-style-type: none"> - Limit activities to daylight working hours. 	Contractor	/	/
Rehabilitation	<i>Traffic Mangement</i>	<ul style="list-style-type: none"> - Develop of the Traffic Management Plan for regulation of traffic during the project activities. 	Contractor	/	1.500€
Rehabilitation	<i>Community safety measures</i>	<ul style="list-style-type: none"> - Informing the public about the construction activities: part of the day when they will be implemented, duration etc., - Limit activities to daylight working hours, - Establishing complaint mechanism (Grievance Redress Mechanism) and involving the stakeholders (local communities and workers) before and during 	Contractor Engineer PESR	/	1.000€

		<p>the rehabilitation of the road section,</p> <ul style="list-style-type: none"> - The Traffic Management Plan will regulate the traffic during the rehabilitation activities, - The access of unauthorized persons on the construction site will be prohibited. 			
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Table 7 Monitoring Plan

Phase	What parameter is to be monitored?	Where is the parameter to be monitored?	How is the parameter to be monitored?	When is the parameter to be monitored? Frequency	Responsibility	Indicative costs (euros)
Traffic safety Safety during rehabilitation activities	Existence of Traffic Management Plan	On project site	Visual inspection	During rehabilitation phase	Contractor Supervision Engineer	1.000€
General Work Safety Safety of the employees, visitors on site	Develop Plan for Occupational health and safety	On project site	The status of implementation of mitigation measures; number of injuries at work place; appointed person/officer for health and safety on site.	During rehabilitation phase	Contractor Supervision Engineer	500€
Air pollution (fugitive emission of dust, emission of exhaust gases from construction mechanization)	Exhaust fumes, Dust	On project site	Visual inspection, Measurement of PM ₁₀ on one point in the	During operation of the mechanization, During material delivery One baseline measurement and one measurement during the construction activities	Contractor Supervision Engineer Licenced company	1.500€

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			village Kukurecani			
Potential pollution of soil and groundwater / contamination of surface water	Soil quality	On project site	Visual inspection for spills and leaks which might impact soil quality (and potentially groundwater)	During rehabilitation activities	Contractor Supervision Engineer	400€
Waste generation (municipal waste from engaged employees, demolition waste etc.)	Implementation of Waste Management Plan	On project site	Visual inspection, contracts with authorized legal/ physical entities	During rehabilitation activities	Contractor Supervision Engineer	1.500€
Noise and vibrations	Noise levels	On project site	Measurement of noise levels on one point in the village Kukurecani	One baseline measurement and one measurement during the construction activities	Licensed company	2.000€
Material transport	Truck load covered	On project site	Visual inspection	During rehabilitation activities	Contractor Supervision Engineer	500€
Construction site	Technical features of the construction equipment	In authorized services and on site	Supervisory Inspection	During rehabilitation activities During operation of the mechanization	Contractor Supervision Engineer	1.500€
Road safety (Increased vehicle speed)	Traffic signs; vehicle speed limitation	Along the road section	Visual observation	During rehabilitation activities	Contractor Supervision Engineer	1.500€

7. Roles and responsibilities for implementation of ESMMP

During rehabilitation of the road section Bitola – Demir Hisar mitigation and monitoring activities will run parallel to the rehabilitation activities. They will commence at the time when employees, equipment and/or materials are moved to the site and will end after the job is completed and all employees, equipment and/or materials are removed from the site and the work at location is complete.

Contractor should provide monthly reports to Public Enterprises for State Roads (PESR) for implementation of foreseen environmental and mitigation measures. PESR will prepare quarterly Environmental Monitoring Reports for submission to the World Bank (WB) according to the received data from all Contractors, authorized bodies of state administration for such type of activities.

Roles and responsibilities for implementation of Environmental and Social Management and Monitoring Plan (ESMMP) are given in Table 8.

Table 8 Roles and Responsibilities for implementation of ESMMP

Company/Unit	Responsibilities
<p>International Projects Management Unit - IPMU (PESR)</p>	<p>In coordination with EPSAU, this Unit will be responsible for overseeing the project implementation, for monitoring the overall project implementation, including environmental compliance of the project. IPMU will have the final responsibility for environmental performance of the project, during project implementation. Specifically, IPMU will: i) closely coordinate with local authorities in the participation of the community during project preparation and implementation; ii) monitor and supervise ESMMP implementation including incorporation of ESMMP into the detailed technical designs and bidding and contractual documents; iii) be in charge of reporting on ESMMP implementation to the World Bank.</p>
<p>Environmental Protection and Social Aspects Unit (EPSAU) (PESR)</p>	<p>This Unit is responsible for monitoring the implementation of WB's environmental safeguard policies in all stages and process of the project. Specifically, this unit will be responsible for:</p> <p>i) reviewing the subproject: ESAR, ESMMP prepared by consultants to ensure quality of the documents; ii) helping IPMU incorporate ESMMP into the detailed technical designs and civil works bidding and contractual documents; iii) helping IPMU incorporate responsibilities for ESMMP monitoring and supervision into the TORs, bidding and contractual documents for selection of Contractor, Supervision, Monitoring contractor iv) providing relevant inputs to the consultant selection process; v) reviewing reports submitted by the</p>

Company/Unit	Responsibilities
	<p>Contractor, Supervision, Monitoring contractor; vi) conducting periodic site checks; vii) advising PESR management on solutions to environmental issues of the project; and viii) preparing environmental performance section on the progress and review reports to be submitted to the WB.</p>
Contractor	<p>Based on the approved ESMMP, the Contractor will be responsible for establishing a site-specific ESMMP for the project site, submit the plan to PESR and Supervision Contractor for review and approval before commencement of construction. In addition, it is required that the Contractor get all permissions for construction (traffic control and diversion, excavation, labor safety, etc. before civil works) following current national regulations.</p> <p>The Contractor shall be required to appoint a competent individual as the contractor 's on-site <i>Health, Safety and Environmental Officer (HSEO)</i> who will be responsible for monitoring the Contractor 's compliance with the ESMMP requirements and the environmental specifications.</p>
Supervision Engineer	<p>The Supervision Engineer will be responsible for supervising and monitoring all project activities and for ensuring that Contractor comply with the requirements of the contracts and the ESMMP. The Supervision Engineer shall engage sufficient number of qualified staff (e.g. Environmental Engineer) with adequate knowledge on environmental protection and construction project management to perform the required duties and to supervise the Contractor's performance.</p>
Ministry of Environment and Physical Planning (MoEPP)	<p>MoEPP is responsible for issuing a decision for approval of Elaborate for Environmental protection and monitoring of the state of implementation of all mitigation measures for environmental protection described in Elaborate for environmental protection.</p>