

# **BOSNIA AND HERZEGOVINA: CORRIDOR Vc MOTORWAY PROJECT ENVIRONMENTAL IMPACT ASSESSMENT STUDY**

## **EXECUTIVE SUMMARY**

This document briefly presents the assessment of the environmental impact of construction, operation and maintenance of the Corridor Vc Motorway passing through Bosnia and Herzegovina.

### **1. Project Description**

The Motorway on the Corridor Vc is a part of the Trans-European ground corridors network. In its final points, it connects the central part of the Adriatic Sea coast and Budapest in Hungary. As far as Bosnia and Herzegovina is concerned, the Corridor Vc route, in its length of 330 km, runs in the North-South direction, i.e. middle part of the country passing through the most favourable conditions – the valleys of the Bosna and Neretva rivers.

The potential environmental impacts of the proposed motorway have been assessed in four separate Environmental Impact Assessments and cover the full length of the Corridor Vc route. The route has been divided into four LOTs as follows:

- LOT 1: Section Svilaj (Northern Border with Croatia) -Doboj South (Karuše),
- LOT 2: Section Doboj South (Karuše) – Sarajevo South (Tarcin),
- LOT 3: Sarajevo South (Tarcin) - Mostar North,
- LOT 4: Mostar North – Southern Border with Croatia.

The full EIA reports can be found at the website of the BiH Ministry of Communications and Transport:

<http://www.mkt.gov.ba/bos/aktivnosti/vcplan.php>

<http://www.mkt.gov.ba/hrv/aktivnosti/vcplan.php>

<http://www.mkt.gov.ba/srp/aktivnosti/vcplan.php>

### **2. Historical Development of the Project**

Plans for a major motorway through BiH have been considered through strategic planning process starting in the late 1970's. The following section provides a historical overview of the site selection process for the Corridor Vc and how the public were able to be involved.

The process to define a motorway through Bosnia and Herzegovina as a part of the Trans-European ground corridors network started in the late 1970s.

Following the Decision of the Assembly of the Socialist Republic of Bosnia and Herzegovina, dated January 28, 1975, relevant institutions initiated drafting of the Spatial Plan of the Republic of Bosnia and Herzegovina, for the period up to the year 2000.

The Spatial Plan was drafted on the basis of the Law on Spatial Planning, and in accordance to the methodology adopted in 1976 by the Committee for Spatial Planning, Protection and Promotion of the Environment. This Plan defined the route of the Corridor Vc Motorway through Bosnia and Herzegovina.

The public were consulted on the Corridor Vc via the Municipalities who were responsible for public consultations prior to providing their approval on the Spatial Plans.

Republic Committee for Urbanism - the main incumbent of the Spatial Plan development (whereas the Executive Council of the Assembly of the Socialist Republic of Bosnia and Herzegovina, being the highest executive authority, was specified to be the main bearer of the preparatory activities) – with the participation of numerous scientific and expert institutions and individuals, drafted a series of studies which were relevant to the development of the Spatial Plan.

The Socialist Republic of Bosnia and Herzegovina (SRBiH) Republic Committee for Urbanism defined the corridor route in 1981 and it was agreed that its adoption was to be regulated at the highest level due to its significance.

After wide public consultations, the Spatial Plan was adopted and signed by the Assembly of the Socialist Republic of Bosnia and Herzegovina on January 11, 1982.

The building of the SRBiH Committee for Urbanism was devastated (destroyed in a fire) during the war, so that the documentation presenting the process of public consultations and the adoption of the act was completely destroyed.

Article 208 of the Rules of Procedure of the Assembly of the Socialist Republic of Bosnia and Herzegovina (1980s) stipulates the necessity to hold public consultations on all the acts of utmost significance, including the widest possible scope of consultations of interested parties, scientific and expert institutions, working people and citizens.

The issue of publication, organisation and follow-up of public consultations, reporting on public consultation outcomes and proposals, obligation to respect the presented points of view and suggestions, as well as preparation of the final report on public consultations was stipulated in Articles 209-214 of the said Rules of Procedure of the Assembly.

Corridor Vc was discussed and formally included in the Trans-European Corridor Network on the Third Pan-European Conference in Helsinki in June 1997.

The proposal for the construction of the North-South Motorway through Bosnia and Herzegovina was constantly supported by the public, and this was re-confirmed in 2004 Poverty Reduction Strategy Papers for BiH. Despite the well-known hindrances in terms of credit capability of Bosnia and Herzegovina in the international capital market, the

Poverty Reduction Strategy Papers Team was of the opinion that those should not be an obstacle to the Government of Bosnia and Herzegovina to launch the motorway construction project, phase by phase, starting from 2007 onwards.

Item V8 of the Strategy – *Infrastructure* within the Chapter “Priorities” clearly stated that the construction of the Corridor Vc Motorway was a *must* task.

The Final version of the Poverty Reduction Strategy Papers was adopted in 2004 by the Council of Ministers of Bosnia and Herzegovina, Government of the Federation and Government of the Republika Srpska. The Strategy was also supported by the Presidency of Bosnia and Herzegovina, and the Parliamentary Assembly of BiH supported its implementation.

The Council of Ministers of Bosnia and Herzegovina decided to build a part of the Pan-European Motorway on the Corridor Vc passing through BiH. Construction costs for this route were assessed at approximately €5 billion.

The purpose of the Project is to enable improvement of connectivity of Bosnia and Herzegovina with its neighbouring countries and the region, enabling, at the same time, stabilization and incentive of development of the country as a whole.

### **3. Development of EIA**

Pursuant to the decree of the Council of Ministers, adopted at sessions held on 10 and 13 October 2003, the Ministry of Communications and Transport of BiH published an international Call for Bids for „Development of the Study-Planning Documentation for the Corridor Vc Motorway“.

An integral part of this study-planning documentation was an assessment of the environmental impact of the Corridor Vc Motorway construction:

The Environmental Impact Assessment was carried out for each LOT respectively in accordance with FBiH Law on Environment (Official Gazette of the Federation of BiH, No. 33/03).

In accordance to the Law on Environment (Official Gazette of the Federation of BiH, No. 33/03), the Environmental Impact Assessment was developed in two phases:

- Scoping,
- Environmental Impact Study.

In both phases, and in accordance to the aforementioned Law, the material was distributed to the stakeholders and/or interested parties determined by the Federal Ministry of Environment and Tourism; public consultations were organized in residential districts nearest to the location of the project; the public was informed on the activities through the media and through the announcements on local communities’ notice-boards. Participation of wide public brought valuable comments and suggestions that were

integrated within the Environmental Impact Study for each LOT respectively and are summarised in the Public Consultation & Disclosure Plan and published on the web site:

<http://www.mkt.gov.ba/bos/aktivnosti/vcplan.php>

<http://www.mkt.gov.ba/hrv/aktivnosti/vcplan.php>

<http://www.mkt.gov.ba/srp/aktivnosti/vcplan.php>

### EIA approval process

Phase	Lot 1	Lot 2	Lot 3	Lot 4
Scoping study approved by FMOT	25.07.2005	26.07.2005	20.07.2005	09.08.2005
EIA documents released to the public	25.05.2006	25.05.2006	27.06.2006	27.06.2006
EIA approved by FMOT	18.06.2007	18.06.2007	19.09.2007	19.09.2007

### Public consultations timetable

Corridor Vc Lots	Date	Location	Number of participants
Lot 1	14 December 2006	Odžak	80
Lot 1	13 December 2006	Usora	25
Lot 1	15 December 2006	Doboj (South)	43
Lot 2	14 September 2006	Žepce	57
Lot 2	27 July 2006	Zenica	76
Lot 2	12 September 2006	Kiseljak	49
Lot 2	31 July 2006	Kakanj	12
Lot 2	27 July 2006	Maglaj	18
Lot 2	28 July 2006	Tešanj	120
Lots 2 and 3	12 September 2006	Hadžici	58
Lot 3	21 September 2006	Konjic	92
Lot 3	19 September 2006	Jablanica	132
Lots 3 and 4	26 October 2006	Mostar	112
Lot 4	31 October 2006	Capljina	37
Lot 4	31 October 2006	Ljubuški	29

### Trans-boundary Issues

Document forwarded to the Ministry for Environment, Urban Planning and Construction of Republic of Croatia by the relevant ministry of Bosnia and Herzegovina (Ministry for Foreign Trade and Economic Relations – Environmental Department) on 22 March 2007.

## 4. Project Objective

The main objective of the construction of the Motorway on the Corridor Vc is inclusion of BiH into the main traffic flows as well as in global European economic system. It is expected that the Motorway will be the prime mover of economic activities in the country.

The Motorway construction will enable connectivity of BiH with its neighbouring countries and regions, aiming at stabilization and development benefits to the country. Improvement of transport conditions will enhance the quality of life, to be manifested through:

- reduction of people and goods transport length and time in comparison to the current situation on the sections,
- reduction of people and goods transport costs,
- reduction of environmental impacts by directing the traffic from the current relevant network toward the future motorway route,
- employment enhancement,
- valorisation of the BiH geo-traffic position,
- enhancement of business competitiveness in the motorway gravitational area,
- launching of new projects and opportunities for private investments in regional economy,
- the motorway connects the middle part of the Adriatic coast, with its great tourism potentials through the port of Ploce with Corridor X, route Zagreb-Belgrade and ends in Budapest;
- improvement of trade links with neighbouring countries and Central Europe;
- acts as a stabilising factor and facilitates development of the country

## **5. Environmental Objective of the Project**

The Environmental objective of the Project aims at preventing, reducing and/or mitigating both direct and indirect impacts of the project on people, flora and fauna, water, air, soil, climate, landscapes, cultural heritage and material assets.

Considering the sensitivity of the environment of the geographic areas that may be affected by the motorway construction, the Environmental Impact Assessment provided the basic data on:

- corridor routes/areas that are to be evaded due to their extreme value or sensitivity (marshes, karst, protected natural and cultural values, valuable forest and agricultural land, water-supply, etc.),
- mitigation measures that are to reduce, mitigate and/or prevent impacts on the environment.

Therefore, the Environmental Impact Assessment represents an important segment of the planning-study documentation and enables a comprehensive evaluation of the Motorway Project. The main objective of the Environmental Impact Assessment Process is to encourage the integration of the environmental aspects into the process of planning and decision-making process, aiming to result in environmentally acceptable activities.

## **6. Current Laws and Regulations on Environmental Protection**

Environmental Impact Assessment was prepared in compliance with the Law on Environment (“Official Gazette of the Federation of BiH”, No. 33/03) as well as the Rules of Procedure on Facilities and Plants, for which the environmental impact assessment is obligatory and Facilities and Plants that may only be constructed and operated when they have an environmental license (“Official Gazette of the Federation of BiH”, No. 19/04).

The Law on Environment was harmonized with the following European and international regulations:

- EIA Directive 85/337/EEC, supplemented by the Directive 97/11/EC (Environmental Impact Assessment of basic industries and infrastructure),
- UNECE Convention on Trans-boundary Environmental Impact Assessment (1991, Espoo, Finland),
- UNECE Convention on Access to Information, Public Participation in Making Decision, as well as Access to Legislation on Environmental Issues (1998, Aarhus, Denmark),
- IPPC Directive 96/61/EC (IPPC – Integrated Prevention and Pollution Control),
- Seveso II – Directive (Prevention of Disasters of Large Scale).

During the Environmental Impact Assessment Process, provisions of other environmental laws were taken into account, as well as regulations developed on the basis of these laws:

- Law on Protection of Nature (Official Gazette of the Federation of BiH, No. 33/03),
- Law on Protection of Water (Official Gazette of the Federation of BiH, No. 33/03),
- Law on Protection of Air (Official Gazette of the Federation of BiH, No. 33/03),
- Law on Waste Management (Official Gazette of the Federation of BiH, No. 33/03).

All the above mentioned laws were adopted in 2003, as a set of environmental laws. The Laws were developed within the PHARE Programme of European Commission and harmonized with European regulations. The Laws are being enforced by the Federal Ministry of Environment and Tourism.

In the preparation of environmental impact assessment documentation, TEM (Trans-European North-South Motorway Project) standards and recommended practices published by the United Nations Economic Commission for Europe (UNECE, Third Edition – February 2002) were taken into account, as well as requirements of international financial institutions (WB, EBRD, EIB).

Guidelines for Designing, Construction, Maintenance and Monitoring of Roads (“Official Gazette of the Federation of BiH”, No. 80/06) will be used in the next phase of the preparation of project documentation, as well as in the construction phase. The Guidelines were prepared in accordance with the EU norms and standards, and have been implemented since January 1, 2007. Within the Guidelines, the environmental issues were elaborated in the book “The Road and Environment“.

## 7. Project Alternatives

The Terms of Reference for the preparation of the study-planning documentation specified the scope of work and tasks that would be required to determine the most feasible route for the Corridor Vc motorway.

Corridor Vc motorway route on BiH territory was defined by the Spatial Plan from 1982 which is still valid. In view of the newly established geo-political and socio-economic relations in the recent past, in addition to the Corridor route defined by the BiH Spatial Plan for the period 1981-2000 (2015), it was also necessary to review alternative routes throughout BiH with the aim to find the most feasible corridor.

Analysing possible alternative corridors in the first phase of the preparation of project documentation did not mean abandoning the route defined by the Spatial plan.

Based on these analyses, the Technical study gave several alternatives for the motorway route, these alternatives were evaluated and three (3) routes were selected for further analyses during the preparation of conceptual design. The conceptual design was the basis for the preparation of EIAs, which confirmed or rejected the corridor route and determined any additional restrictions or conditions.

Environmental aspect is one of the four main MCA criteria for selection of the most feasible route.

**Table of analysed and selected routes**

LOT No.	Alternative routes considered using MCA*	Alternative routes considered in conceptual design	Selected routes
LOT 1	8	3	1
LOT 2	3-4	(detailed spatial planning documentation was available)	1
LOT 3	5	3	1
LOT 4	13	3	1

Multi Criteria Analysis (MCA\*) has used 4 main criteria:

- 1) Spatial
- 2) Ecological (environmental)
- 3) Traffic
- 4) Economic.

The main change of the route of the Corridor Vc has been carried out in Lot 4 to avoid any connection of the motorway with Hutovo blato, which has been included in the RAMSAR List of Wetlands of International Importance, and in the Important Bird Areas

Program implemented by the Bird Life International. The selected route in Lot 4 has been relocated and it will be connected with the Croatian port of Ploče.

## **8. Description of the Current Environment**

### **Spatial scope of environmental impact assessment (EIA)**

With regard to possible direct and indirect impacts, as well as possibility of assessment of potential negative impacts of motorway construction, the scope of the motorway route assessment comprises a one-kilometre strip of land on both sides of the final contour line of the selected route. Special attention has been paid to the 250 m strip of land on the left and right side of the road axis.

### **Relief**

**LOT 1** starts at the bridge across the Sava river (the bridge has been a joint investment of Bosnia and Herzegovina and Croatia), and in its first part, it stretches along the Bosna river bank. The route is laid along the western rim of the Posavina Region (130 m above sea level), then on the terraces on both banks along the Bosna river to Rudanka settlement. After Rudanka settlement, the route approaches hilly terrain, and then the valley of the Usora River, avoiding collision with the existing urban infrastructure of Doboj residential district.

**LOT 2** starts at Karuša settlement (Doboj). With regard to its relief-morphological characteristics, the terrain of the Karuša – Sarajevo South (Tarcin) Section of the motorway route has all the characteristics of a hilly-mountainous terrain. The route passes the terrain with unfavourable topographical conditions, which require the construction of numerous bridges and tunnels along the route.

**LOT 3** starts at the loop in Tarcin. The route passes through extremely unfavourable mountainous terrain. The section surmounts Ivan Mountain, the massif of Prenj Mountain and crosses over Jablanicko Lake. Due to extremely unfavourable relief-morphological characteristics, bridges, viaducts, and/or tunnels will have to be built on 2/3 of the section. The longest tunnel (6,4 km) runs through the massif of Prenj Mountain.

**LOT 4** starts at the Mostar North chainage. The route stretches along the slopes of Velež Mountain above Mostar, and then bypasses settlements in Bišća polje and runs down to the Buna river. The route bridges the Buna and Bunica rivers at the very spot of their exit from the canyons. Then, the route bypasses Pocitelj, runs across the Neretva river and continues toward hilly-mountainous terrain near the border with Croatia. Due to unfavourable relief-morphological and hydrological characteristics, many bridges, viaducts and/or tunnels have been anticipated.



### **Soil and agricultural land**

**LOT 1:** In the wider area of the Corridor Vc route – LOT 1, lithic substrates prevail, making a basis for the existing soils: alluvial-diluvial deposits, tertiary clay, alumina oxide and argil, sand, slates, marlstone and solid limestone. Such a structure of the basic foundation indicates that those soils have become susceptible to erosion. In its longest length, the motorway route runs over the agricultural land that is more or less used and arable, depending on the terrain conditions. 70% of the total area is under agricultural land, while other surfaces are under degraded forests, sloping agricultural land, or land where agriculture is limited due to high levels of ground waters.

**LOT 2:** As for the types of soil in the area of the Section Doboj South (Karuše) – Sarajevo South (Tarcin), the most frequent is Eutheric cambisol with 28.5% and Distric cambisol with 24.9%, and the rarest is Lithosol.

Agricultural land is about 39.1% of the total strip of land observed (500 m of width). Other strips of land are under forest (22.5%), constructed facilities and rivers.

**LOT 3:** In the area of the Section Sarajevo South (Tarcin) – Mostar North, rocky terrain prevails. 90% of the affected area falls within hilly-mountainous relief, with 500 m and over 500 m height above sea level, and only 10% is flat land with 500 m above the sea level. Regarding the terrain, the rocks may be divided into two groups: solid and soft rock and disconnected land. Solid, carbonated rocks of Mesozoic age are located in the northern and southern parts of the route and include approximately 50 % of the route. Soft rocks and disconnected land are located in the central part of the terrain. Erosion processes have been registered within the neogenic and verfenic poly-facial complex in Triassic dolomites. Only 10% is arable land.

**LOT 4:** Route of the Section Mostar North – South border in its whole length passes through karst belonging to High Karst of the Exterior Dinaric Alps. Rocky mass is composed of quart deposits, fluvial-glacial deposits, alluvial half-luvial deposits, limestone of upper Jurassic period, limestone of lower Cretaceous, dolomites of Cretaceous age, etc.

This section comprises 76.59% of forest land and 19.05% of agricultural land. Agricultural land of great value is located in valleys of the rivers Neretva, Buna, Bunica and Trebižat in Mostarsko polje.

### **Climate**

Considering the specific geographical position and relief, the climate of Bosnia and Herzegovina is complex. It can be defined in three separated parts, with more or less clear boundaries, as follows:

In the North: moderate-continental, i.e. mid-European climate (LOT 1);

In the central part: continental-mountainous, i.e. Alpine climate (LOT 2 and LOT 3);

In the South-Western part: Mediterranean, i.e. maritime climate (LOT 4).

Occurrence of fog and lower visibility, especially in autumn, is significant for LOT 1 and LOT 2. Climate of LOT 2 and LOT 3 is characterised by strong snowfalls. For LOT 4

section, characteristic occurrences are strong winds and great quantities of rainfall in autumn and spring, especially around Mostar.

### **Water**

**LOT 1 and LOT 2:** Within the route of the motorway, there is a dense network of waterways in both of these sections. The most important one is the river Bosna with its bigger and smaller tributaries. Besides the dense network of surface waterways, there are also significant groundwater resources, majority of which is still unexplored. When laying the route, special attention was paid to sources of public water-supply systems for cities and settlements along the sections, in order to avoid and protect the water sources as well as their water-protection zones.

Analysing the Corridor hydro-geological characteristics, the Study determined 11 sensitive areas for groundwater on the LOT 1, and as many as 33 on the LOT 2, i.e. water-bearing strata that are a significant source of quality drinking water needed to meet the increasing demand.

**LOT 3:** The largest part of the terrain of LOT 3 belongs to the basin of the Neretva river, while Northern and North-Eastern parts of the LOT 3 belong to the basin of the Bosna river. Watershed between those two basin zones is orographic and lies within the zone of the LOT 3 on Ivan mountain. The Neretva river may be considered a karst river, although its springs are not in the karst area. In terms of hydro-geology, approximately 80% of its surface shows typical karst interactions. All groundwater and surface flows are directed towards the Neretva Canyon, which is the deepest erosion basin within the researched area. Although the region has large quantities of water, it is known to be „dry and thirsty“. The main cause of this is the unequal distribution of rainfall per year, although the average values are 1500 mm (almost 50% more than the average in Bosnia and Herzegovina).

Due to the karst terrain, the whole area of Neretva river basin should be considered as sensitive.

**LOT 4:** The whole length of the LOT 4 Section is running through the Neretva river basin, which has all the specific hydrological characteristics of karst. The Neretva river is known for its uneven flow during the year. Summer flows are low, the winter ones are high. Its tributaries often have flood characteristics. For such motorway sections crossing the flood waterway, two analyses need to be carried out: 1) analyses of potential large amounts of water of 100-year rank, 2) analyses of possible appearance of deposits.

The whole area of the Neretva basin may be considered sensitive, due to the karst terrain. Especially sensitive area is the Natural park – Hutovo blato, which has been included in RAMSAR List of Wetlands of International Importance, and in the Important Bird Areas Program implemented by the Bird Life International.

### **Air**

General observation: No baseline data on the air quality was available as the system for air quality measurement did not exist and no specific air quality measurements were performed in order to establish the baseline information. Calculations of emissions were

made and detailed information for the whole length of 340 km of motorway route is available in studies for each of the four LOTs.

**LOT 1:** Within the scope of this section, no air quality analyses are being performed. Thus, there is no relevant data on air pollution measurements. Only measurements of this kind were performed during the construction of the bridge across the Bosna river in Modrica. However, those basically local data can not be applied to the whole length of the section.

**LOT 2:** This section passes close to some very important industrial areas. Zenica and Kakanj with their heavy industries were the most polluted cities in Bosnia and Herzegovina in 1980s and 1990s. Due to the war destruction of industrial facilities and the difficult post-war reconstruction, the level of pollution has significantly decreased in comparison to the pre-war period. According to the estimations and measurements of the emissions, it may be concluded that annual concentration of polluting substances does not exceed the maximum allowed values.

**LOT 3:** There are no significant sources of pollution in this region; therefore, no measurements of the air quality have been performed.

**LOT 4:** The Section passes through the region with no significant air polluters. The exception is the city of Mostar, in which the main polluter is traffic.

### **Flora**

General observation: With regard to flora, numbers and types of species can be found in the studies for each of the LOTs. The motorway route runs through various geographic and climatic regions, so that various species of flora are specified not only per LOTs but also per mileage.

Detailed classification per number and type (species, family, and subfamily) would also need to take into account the characteristics of the inanimate surroundings where the species is found, which would require a separate study or document. As there were several hundred species identified, the studies did not include a systematic classification of flora.

The summary listed only the most relevant flora species and the most important rare species, which should be sufficient to prompt those interested in biodiversity to look for additional information in studies.

**LOT 1:** Natural conditions, relief and climate directly influenced the appearance and state of vegetation cover in the affected area. Original vegetation has been significantly transformed by anthropogenetic factors. Nevertheless, the area is famous for its diversity of ecological systems and habitats. Habitats of English oak, common oak (*Quercus petraea*) and European or common hornbeam, were registered. In some places, there are beech woods of pre-mountain strip.

Despite the fact that lawns are not of natural origin, they represent habitats which, in great extent, enrich biological as well as landscape diversity of the affected area. As for the lawns, they are characterised by various species of grass, such as true grasses (*Poaceae*), small pink asteraceae (*Asteraceae*), poverty rush (*Juncus*), mint (*Mentha*), that

are present in humid habitats. Vegetation is mostly meadows of perennial ryegrass and common plantain, community of *Polygono-Bidentetum*, community of tansy and wormwood, and meadows and pastures of dwarf elderberry.

**LOT 2:** Significant habitats and great biological diversity have been registered in this Section. Woods of hornbeam and lungwort oak (*Quercus-Ostryetum carpinifoliae*), community of ecosystems of swamp-willow woods (*Salicion albae*), basophyl pine woods on serpentines (*Pinetum silvestris-nigrae serpentinicum*), xerophyl oak wood on serpentines, common oak wood with *Erico-Quercetum petrae*; heaths, vegetation of rocks and rocky ground, community of ecosystems of swamp willow (*Salicion albae*), community of ecosystems of hygrophile woods and bushes of alder, community of ecosystems of mezzophilic meadows, community of ecosystems of hydrophilic meadows, as well as ecosystems of tertiary vegetation and community of ecosystems of urban and rural areas.

**LOT 3:** The Section runs through the 6.4 km long tunnel under Prenj mountain, and borders with the future National park Prenj, Cvrsnica, Cabulja. This region will be proclaimed National park for its extraordinary biological and geomorphologic diversity. Endemic sub-mountain woods of Bosnian pine (*Pinus heldeichii*) have been found in the area of the LOT 3.

The LOT 3 section is also rich in black pine woods (*Pinus nigra*), European beech (*Fagus sylvatica* L.), and European or common hornbeam (*Carpinus betulus*), with some European silver/white birch (*Betula pendula* Roth), elm (*Ulmus glabra* huds.), black locust/acacia (*Robinia pseudoacacia*), oak (*Quercetum confertae*) and European/Turkish oak (*Cerris hercegovinicum*), etc. Thorn bush (*Petteria ramentacea*) and mistletoe (*Viscum album*) are often found. The region is rich in endemic species such as: *Dianthus prenjus*, *Euphorbia hercegovina*, *Dianthus freynii*, *Saxifrage prenja*, *Amphoricarpus autariatus*, *Campanula hercegovina*, *Edraianthus hercegovinus*, *Gentian dinarica*, *Oxytropis prenja*, *Leontodium nivale-hercegovinus*, etc.

**LOT 4:** Proposed LOT 4 route of the Corridor Vc passes through sub-Mediterranean belt of Mediterranean vegetation region. Natural forest vegetation includes woods and bushes of silver hornbeam with several communities within it (woods of silver hornbeam with thorn bush, or woods of silver hornbeam with horse tongue, etc.), depending on ecological conditions. Large areas of those woods and bushes near the route suffered significant degradation. Therefore, the largest part of the terrain near the route is covered by plant communities of Mediterranean and sub-Mediterranean rocky terrain. The most numerous are the endemic species of Eastern Adriatic coast, present also in other parts of Bosnia and Herzegovina. According to available data, in the area of proposed LOT 4 route of the Corridor Vc, there are no plants that are specific for that region only. Along the route, one can find species protected by law in BiH – common maidenhair (*Adiantum capillus-veneris*, deposits of crystalline calcium carbonate barriers of the Kravice waterfall), as well as thorn bush (*Petteria ramentacea*) that, pursuant to the Law on Protection of Forests in BiH, must not be cut, uprooted or damaged.

## **Fauna**

**LOT 1:** The largest part of this section of the route is passing through the region with habitats of small game, and partly large game, as well. Species dwelling in the area affected by the selected route option, and which are important for hunting, are rabbit (*Lepus eropaeus* Pallas), grey partridge (*Perdix perdix* L.), pheasant (*Phasianus colchicus* L.), quail (*Coturnix coturnix* L.), and various species of swamp birds (wild ducks, gees, moorhens, etc.), mostly near waterways. As for the large game, there are roe deer (*Capreolus capreolus* L.) and wild boar (*Sus scrofa* L.).

**LOT 2:** This section of the route passes through the densely populated area. In the part of the route that passes through the forests, habitats of large game, such as wolf, bear, roe deer, wild boar, were registered. Forest regions are rich with rabbits, foxes, pheasants and quails. In the area of this road section, 26 species of birds were registered, some of them make their nests in this region, and some fly over during migration. Swampy parts around Karuša to Ozimica are habitats to several species of amphibians.

**LOT 3:** In the area of the LOT 3 route, different types of habitats are present: woods, meadows, rocky terrain, as well as several types of water habitats, making this area extremely biologically diverse. As for large game, the population of chamois is the most important species. There are also important habitats of wolf and bear. Regarding fish, important species are marble trout of Neretva and huchen, which are endemic species, then rainbow trout, introduced grayling, sheepshed bream and coattail. Large number of amphibians and reptiles is present as well.

**LOT 4:** In wider area of the Mostar North – Southern border Motorway Section, there is a series of habitats inhabited by different kinds of animals. Among them, especially significant are relatively stable populations of wild life, bear and wolf. The most important habitat in this area is Natural Park Hutovo blato. According to the referential data, 162 species of birds reside here. Significantly larger number of birds, including migratory species, is mentioned as well. The area is habitat to many reptiles, amphibians, fish and insects.

## **Protected natural areas**

**LOT 1:** There are no protected natural areas.

**LOT 2:** Within this section, the Žepče Municipality, by means of its Decree, protected the serpentine complex within the zone of Papratnice, where many floral species, significant to serpentine flora, are growing.

**LOT 3:** Pursuant to the most demanding scientific criteria, the mountains Prenj, Cvrsnica, Cabulja with the Neretva river represent exceptional natural resources. This area has been declared as the area of importance for the Federation of Bosnia and Herzegovina, and the process is underway to declare it protected area – national park.

**LOT 4:** The most important protected area is Hutovo blato which has been included in RAMSAR List of Wetlands of International Importance. Other protected sites are Vrelo

Bune (the river Buna spring) in Blagaj, Vrelo Bunice (the river Bunica spring), the river Neretva in Mostar Municipality, the river Trebižat valley, an island on the Neretva river near Pocitelj, Kravice waterfall, cave Ševrljica and Green cave in Blagaj, and an unnamed cave in Podveležje.

### **Landscape**

**LOT 1:** The wider region of the affected area is characterized by two main landscape types: valleys and hilly landscape, so that the whole area has visual characteristics of both landscape types. The landscape of lowland areas is mostly characterised by alternating forests and agricultural surfaces. Lowland landscape is longitudinally cut through the middle by the waterway of the river Bosna. Elevations of the hilly landscape are covered with forests and pastures. In this hilly region, there are many family houses of suburban type with well-developed vegetable garden. Larger settlements, located along the route of this section, were also incorporated in its landscape characteristics.

**LOT 2:** The larger part of the route runs along the river Bosna valley, through hilly-mountainous area. As for the characteristics of the landscape, there are agricultural properties in the river Bosna valley, as well as valuable forest and floral communities in hilly and mountainous parts. The settlements close to the motorway are mostly dispersed. Most settlements are rural and fit well in the existing landscape. This type of settlements can also be found in suburban areas of Zenica, Tešanj, Maglaj and Žepča.

**LOT 3:** Basic landscape elements are natural systems and systems generated by human activities (agricultural land, settlements and infrastructure). Settlements are closely linked to transport system, and through it, with natural morphology. The area is typically mountainous with river valleys, hills, mountain peaks and formations of bare karst in the valley of the Neretva river. The peaks of mountain ranges represent a typical example of a non-inhabited alpine area. Woods, meadows, pastures and waters of the area are extremely rich in flora and fauna species. Large residential districts are Tarcin, Konjic and Jablanica.

**LOT 4:** This section of the route runs through a typical karst area made of karst plateau of Mostarsko polje, karst fields around the rivers Buna, Trebižat and Studenica, slopes of Prenj mountain in the North and Velež mountain in the East. Vegetation is typically sub-Mediterranean. The landscape of the region is rich in exceptional natural resources, such as the Hutovo blato marshland (included in RAMSAR List of Wetlands of International Importance) and cultural-historical heritage sites, such as the Old Bridge in Mostar (entered in the UNESCO List), Pocitelj, Blagaj (on the UNESCO Tentative List), etc. The largest settlements are the city of Mostar and Capljina.

### **Cultural-historical heritage**

**LOT 1:** In the examined area of this section of the route, 12 cultural heritage objects and 5 archaeologically protected sites were registered. The medieval Castle in Doboj and Old town of Doboj are on the Temporary list of National Monuments of Bosnia and Herzegovina.

**LOT 2:** In this section of the route, 10 objects or constructional facilities have been declared national monuments of BiH, while 21 object and constructional facilities are on the Temporary List of National Monuments.

**LOT 3:** In the examined area of this section of the route, there are no national cultural monuments, or sites entered in the Temporary List of National Monuments. All the sites processed by this Study have the status of sites of the III category and registered sites (literature, studies, catalogues, etc.). In the wider area, certain number of pre-historic archaeological sites, as well as sites dating from the Roman and medieval periods were registered.

**LOT 4:** A large number of national monuments are located in the wider area of this section of the route. The most important are the Old Bridge in Mostar and the Old town of Mostar, entered in the UNESCO List of Cultural Heritage. The settlements of Blagaj and Pocitelj have been entered in the UNESCO Tentative list. In the immediate vicinity of the Section, 24 archaeological sites were registered.

### **Settlements and population**

A stand-alone Resettlement Action Plan (RAP) is being developed that will further define the potential number of project-affected people. At present it is calculated that up to 846,283 people live or work in the corridor route.

**LOT 1:** The Section runs through the following Municipalities: Odžak, Vukosavlje, Modrica, Doboj, Usora and Doboj South. Total population in these municipalities is 143,525 inhabitants. The largest municipality is Doboj Municipality with 80,464 inhabitants, and the smallest is Doboj South Municipality with 4,852 inhabitants.

**LOT 2:** The Section runs through the following Municipalities: Usora, Tešanj, Maglaj, Žepce, Zenica, Kakanj, Ilidža, Hadžici and Kiseljak. Total population in these municipalities is 370,962 inhabitants. The largest municipality is Zenica with 128,657 inhabitants, and the smallest municipality is Usora Municipality with 7,100 inhabitants.

**LOT 3:** The Section runs through the following Municipalities: Hadžici, Konjic, Jablanica and the city of Mostar (Mostar has the status of a „city“). Total population in these municipalities is 168,728 inhabitants. The most densely populated area is the city of Mostar with 105,454 inhabitants, and the smallest municipality is Jablanica Municipality with 13,065 inhabitants.

**LOT 4:** The Section runs through the city of Mostar and the following Municipalities: Capljina, Ljubuški i Stolac. The Motorway borders with the Stolac Municipality and runs along 2 km of its border. Total population in these municipalities is 163,058 inhabitants. The most densely populated area is the city of Mostar with 105,454 inhabitants, and the smallest municipality is Stolac Municipality with 13,001 inhabitants.

### **Existing road infrastructure**

The Corridor Vc Motorway runs from the North towards the South, in parallel with the alignment of the trunk road M17 (Bosanski Šamac – Doboj – Zenica – Sarajevo – Mostar – Doljani). The route cuts through the trunk roads M4, M5, M6, M4.1, M6.1, M18, M17.2, M17.3 and M16.2, as well as many regional roads.

## **9. Potential Impacts of the Motorway on the Environment**

The project of the Corridor Vc Motorway construction may have significant impacts on the environment. The most important impacts are as follows:

- emissions into the air,
- emissions into the water,
- noise,
- construction and other waste disposal,
- impacts on the flora and fauna,
- impacts of construction works and emissions on the landscape, soil in the vicinity of the construction site, cultural-historical monuments, population and infrastructure.

### **Impacts on the soil and agricultural land**

The following potential impacts on the soil and agricultural land have been identified:

- physical destruction of the soil,
- permanent loss of the land,
- degradation of the land (erosion, landslides, stagnant waters, compaction and deterioration of the soil)
- division of the area, leading to division of agricultural and other land,
- preventing access to agricultural land plots, directly influencing business activities of local population,
- emissions of gases, dust particles, heavy metals and polluted waters, leading to contamination of the surrounding land,
- using the land for solid waste disposal,
- using the land to set up the construction site and passage of heavy machines during the construction phase,
- usage of salts and chemicals for snow melting during the operation phase.

### **Impacts on climate**

Microclimate in the vicinity of the motorway may change as a result of the characteristic of asphalt to absorb heat of the sunrays. It may cause the decrease in relative air humidity, impacts on the regime of vertical airflow above the road and evapo-



transpiration. This change of the microclimate may be evident in the more immediate area of the Motorway.

### **Impacts on water**

Construction and usage of the Motorway may have a large impact on the water, especially in vulnerable areas (waterways banks, springs in and out of the water-supply systems), on intersections of motorways and waterways, and in karst areas.

During the construction phase, the following potential impacts have been identified:

- disruptions of existing flow of underground feeders due to mining, deep excavation sites, etc,
- creation of new catchment areas with turbid / muddy waters,
- placement of heavy machines depots or asphalt depots close to the rivers or ground waters,
- uncontrolled disposal of excavation material and other waste,
- uncontrolled drainage of sanitary wastewater,
- possibility of accidents resulting in leakage/spills of fuel or lubricants into the environment.

During the operation phase:

- pollution caused by mixture of precipitations and lubricating agents (fuel, oil, lubricants.), pieces of tyres and products of the wear and tear of the upper layer of asphalt, emissions generated by vehicle combustion processes,
- pollution caused by spills as a result of traffic accidents.

The level of pollution of the water coming from the motorways will be directly linked to the number of vehicles using the motorway. Taking into account the forecasted average annual daily traffic of 20,000 vehicles, it is possible to expect potentially significant impacts on surface and ground waters.

### **Impacts on air**

The following potential air pollutants have been identified:

- soot particles,
- dust particles,
- carbon monoxide (CO),
- nitrogen oxide (NO<sub>x</sub>),
- sulphur dioxide (SO<sub>2</sub>),
- hydrocarbons (C<sub>x</sub>H<sub>y</sub>),
- lead (Pb).

During the construction phase, the emission of volatile organic compounds (VOC) from asphalt may be significant. Those chemical compounds have a high percentage of polycyclic aromatic hydrocarbons (PAH) which are defined as hazardous substances.

During the operational phase, the air quality will depend on the location of the route, intensity and velocity of traffic, type and quality of fuel, conditions of vehicles and their maintenance and age, meteorological conditions, construction and vegetation along the route.

Concentration estimations indicate that potential negative impacts are to be expected only in the immediate vicinity of the motorway.

### **Noise**

Noise generated by vehicles travelling on motorways impacts the environment, contributes to the degradation of the quality of life and disturbs the wildlife. The Corridor Vc Motorway will be located in the vicinity of large settlements (Doboj, Zenica, Sarajevo, Mostar), as well as near many smaller settlements. The area along LOT 2 route is especially densely populated.

Motorway noise has 4 main sources: (a) motor vehicles, (b) friction between the vehicle and motorway surface, (c) drivers' behaviour, (d) construction and maintenance activities.

Traffic noise is intermittent, inconsistent in its intensity and with sporadic impulses that appear at the moment of passage of heavy freight vehicles. Noise impact on the environment is an important factor that is to be taken into account when planning the mitigation measures.

### **Impacts on flora**

The following potential impacts have been identified:

- loss of habitats,
- fragmentation of habitats,
- loss of stability and preservation of ecosystem structure,
- felling of trees and other forest vegetation, removing the grass cover during the construction phase,
- emission of harmful substances that have negative impact on plants,
- emission of harmful substances into the water, having indirect impact on the flora,
- introduction of new plant species along the motorway route and disturbance of dynamic balance of natural ecosystems,
- endangering endemic and protected plant species, especially on the LOT 3 route.

Motorway will be passing through regions with different types of vegetation, from the alpine to the Mediterranean; therefore, special attention will be paid to specific impacts of the motorway on each ecosystem.

### **Impacts on fauna**

The following potential impacts have been identified:

- loss of habitats, especially direct loss of underground ones,
- fragmentation of habitats,
- loss of stability and preservation of ecosystem structure,
- cutting through migratory ways,
- running over animals on the motorway,
- impacts on hunting,
- impacts on water fauna due to the construction of bridges,
- impacts on birds due to felling of trees, especially during the birds' sitting on eggs,
- impacts of emission of harmful substances into the air, water and soil, especially in case of accidents.

In the construction phase, the greatest attention will be paid to the impacts of the motorway on fragmentation and loss of habitats.

### **Impacts on the protected parts of nature**

The Motorway route will avoid the protected areas or runs through tunnels under such areas. The edge of the Hutovo blato wetland is approx.3 km away from the motorway route. As for the future National Park, Prenj-Cvrsnica-Cabulja, the route will be passing through the 6.4 km tunnel under these mountains.

### **Impacts on landscape**

Motorway construction changes the landscape and leads to visual pollution. The following potential impacts on the landscape have been identified:

- change of the visual image of the landscape,
- reduction of the current grassy areas,
- cutting through the current grassy areas,
- degradation of soil and land,
- burdening the environment with pollutants,
- disrupting visual contact of nearby settlements with the surroundings.

### **Impacts on the cultural-historical heritage**

The following potential impacts have been identified:

- impacts on physical structure – substance degradation,
- impacts on aesthetic / visual quality, historical or cultural character of the heritage,
- impacts on the surrounding of the cultural-historical heritage.

In general, the „high risk zone“ has been identified, including the strip of land stretching for about 200-300 m on both sides (right and left) of the motorway, depending on the relevant terrain morphology, type of the vehicle and type of the heritage.

### **Impacts on the settlements and population**

The following potential impacts have been identified:

- land acquisition, especially for agricultural land,
- demolition of residential facilities,
- loss of arable land,
- fragmentation of arable land,
- breaking the links between land plots,
- uncontrolled development along the planned route,
- cutting through traditional local roads leading to a loss of social cohesion,
- temporary traffic disruption during the construction,
- setting up the construction site and its infrastructure and taking the land for that purpose,
- noise and environmental pollution caused by the emissions generated during the motorway construction and exploitation,
- pollution caused by accidents.

The project will also lead to increased mobility and potential job creation, skills development.

### **Impacts on the existing road infrastructure**

Upon completion of the motorway, the traffic workload on the existing main and regional roads will be reduced in comparison to the current state. In some sections, the expected reduction amounts to 400%.

### **Specific impacts caused by Unexploded Ordnance (UXO)**

As a consequence of war activities, minefields are still present on the territory of Bosnia and Herzegovina. They have been partly registered and officially located. Bosnia and Herzegovina Mine Action Centre has developed a map of mine fields, showing the cleared areas, problematic (i.e. suspect of having mines) areas, high-risk areas and areas that are still mined.

That map can be considered only as a reference point, because it is possible that, due to the war activities, there was no time to collect the precise data on all mine field locations.

Due to the tectonic ground movements and impacts of water, which is a continuous natural process, it is realistic to expect the movements of mines as well. Consequently, parts of marked mine fields are deformed, without the possibility to monitor these changes.

In view of the above, prior to starting with the preparation of the Main design, the Investor should request from BH MAC the official information whether there is any danger of mines in the relevant area.

If the relevant construction area has been cleared of mines, BH MAC issues the appropriate confirmation. Otherwise, if there is a definite or possible danger from mines, the Investor submits the request for de-mining to BH MAC. The work on the relevant area can start only upon receipt of a response from BH MAC, confirming that the area has been cleared of mines.

### **LOT Specific Environmental Impacts**

**LOT 1** As the route of the Svilaj – Doboj South (Karuše) section first runs through valley terrain and then through the hills and along the Bosna river, the following key potential impacts were identified:

- impacts on high quality agricultural land (loss of quality agricultural land, division of land plots, changing the purpose of land usage, pollution during construction and exploitation),
- impacts on ground and surface waters (positioning facilities in the area of aquifers with high level of groundwater, bridging, route construction along the Bosna river waterway and its tributaries, setting up the construction site, uncontrolled deposit of materials and waste, pollution – especially in case of accidents – deposits, erosions, etc.)
- trans-boundary impacts on Croatia, especially its water resources.

**LOT 2:** The LOT 2 Section, Doboj South (Karuše) – Sarajevo South (Tarcin), will be passing through the densely populated hilly-mountainous region and the valley of the river Bosnia. 93 settlements were registered, including the cities of Doboj, Zenica, Kakanj and the capital of Bosnia and Herzegovina – Sarajevo. The key potential impacts are:

- impact on populated areas (land and facilities acquisition, facilities demolition, infrastructure displacement, traffic disturbances, more difficult communication, pollution of air, water, soil; noise, etc.)
- impact on surface and groundwater, especially on water-supply systems and their protection zone (water-supply system of Zenica in the vicinity of the route, great number of local springs for water-supply, bridging the waterway and route construction near the Bosna river, setting up the construction site, uncontrolled deposit of materials and waste, pollution – especially in case of accidents – deposits, erosions, etc.)
- impact on biodiversity (great number of various forest communities, among which the most significant are basophile pine forests on the serpentines of Papratnica, game and other wildlife: wolf, wild boar, fox, quail, pheasant, etc.)

**LOT 3:** The LOT 3 Section, Sarajevo South (Tarcin) – Mostar North, will run through the distinct mountainous area, so approx. 90% of the route will be located at 500 m above sea level, and numerous bridges and tunnels will be constructed on 2/3 of the route. The key potential impacts have been identified:

- impact on biodiversity of the protected areas (the mountains Prenj – Čvrsnica – Čabulja were declared an area of special interest for the Federation of BiH and the process is ongoing to declare it a National Park. The region is rich in various flora and fauna species, rare and endemic species of plants; populated by chamois, bear, grouse, etc.)
- large quantities of excavation site material (excavation material from anticipated 35 tunnels is to be ca 8 million of m<sup>3</sup>, and ground excavation material is to be approx. 16,5 million m<sup>3</sup>).
- climate impacts, especially snowfalls (this is the region of significant snowfalls during the period from September to June).

**LOT 4:** The LOT 4 Section, Mostar North – Southern border in its whole length will be passing through the area belonging to the High karst of Exterior Dinaric Alps. The climate is sub-Mediterranean. The following key potential impacts have been identified:

- impacts on karst region (specific hydrological regimes, underground rivers, flood waterways, great differences in water flows during the year; permeable, partly impermeable and impermeable soils, having a function of hydrological barrier in the karst region, active and time-to-time active abysses (places where a river sinks into the earth, etc.)
- impact on cultural-historical and natural heritage (Old town of Mostar is on the UNESCO List of Cultural Heritage, Blagaj and Pocitelj are on the Tentative UNESCO List, Hutovo blato is on RAMSAR List of Wetlands of International Importance, great number of other national monuments, nature parks and protected natural resources),
- trans-boundary impacts on Croatia, especially on the Neretva river delta, which is also on the RAMSAR list

## **10. Measures to Reduce, Mitigate and/or Prevent Impacts on the Environment**

Measures to reduce, mitigate and/or prevent impacts on the environment will be taken in all phases of project implementation. The Environmental Impact Assessment Studies include environmental action plans which recommend the mitigation measures to be applied in the following phases:

- designing and planning,
- construction phase,
- monitoring and maintenance.

Anticipated measures may be grouped in three groups:

- general measures of environmental protection,

- special measures,
- technical measures of protection.

**General protection measures** that are to be applied in the designing and planning phase, for each four LOTs, are:

- re-directing the route with the aim to avoid the protected natural and cultural-historical values,
- re-directing the route with the aim to stay away from important migratory ways,
- securing the well-designed and located crossings and passages,
- using the architectural solutions that fit the landscape,
- including physical noise-protection barriers in plans,
- setting up of disposal sites,
- anticipating adequate signalling, including the lighting,
- including hard shoulders and/or paved crash barriers and safety crossings,
- anticipating the works on discharge for risk reduction, in accordance to previously performed researches,
- planning the state level road taking into account the locations of sensitive and unique areas,
- surveying the environmental vectors in the affected area and taking steps to avoid habitat creation, wherever possible.

**General protection measures** that are to be applied in the construction phase are:

- sourcing of raw materials from authorised sites,
- collecting and recycling lubricants,
- installing and using the equipment for air pollution control,
- reducing dust on temporary roads by periodical watering,
- protection of sensitive surfaces with mulch or textile, and re-planting of erosion-prone surfaces, as soon as possible,
- periodical health check of workers, with medical treatment if needed,
- setting up the services for flora and fauna rehabilitation, as well as adequate control posts,
- prohibition of poaching, provision to be included into the employment contract.

### **Protection of the soil and agricultural land**

Identified mitigation measures are as follows:

- removing and disposing off the productive layer of soil,
- keeping and reusing humus,
- securing all slopes from erosion (excavation sites),
- landslide rehabilitation,
- enabling ground clearance and access to agricultural plots,
- remediation of degraded land,
- decontamination of contaminated land (oils, lubricants),
- compensation for damaged land,
- growing vegetation strips.

### **Raw Material Sourcing**

Anticipated mitigation measures are as follows:

- use excavation material, where possible,
- storage of excavation material surplus for later usage,
- ensure that borrow pits are used only in case of shortage of raw materials,
- ensure that borrow pits are located outside the geographically sensitive and vulnerable areas,
- use stone from the existing licensed quarries only,
- transport material on pre-determined routes only.

### **Disposal of construction material and waste management**

Identified mitigation measures are as follows:

- driving away the municipal solid waste from the construction site and service centres to approved landfills,
- storage of hazardous waste to specially determined and marked places,
- providing for hazardous waste collection and disposal through institutions specialized for hazardous waste management.

### **Protection of surface and ground waters**

As for protection of surface and ground waters, a series of measures for negative impacts mitigation and prevention has been anticipated. The basic measures are:

- avoid collision with water-supply facilities,
- designing the restoring parapets or cement concrete ducts (New Jersey) on spots where the route crosses the waterways and zones of protection of drinking water,
- avoid redirection of natural waterbed,
- special manner of mining in order not to disturb the direction of groundwater and supplementary feeding of surface waters,
- use only clean, natural materials in the vicinity of waterways,
- protection of river bank areas from erosion by stabilization substances and erosion-preventing plants,
- by means of a drainage system collect run-off water from the construction site in waterproof reservoirs, and filter such water before drainage into the recipient,
- ensuring waterproof surfaces to keep and maintain heavy machines,
- collecting oil-polluted rainwater from the construction site,
- construction of drainage system in the motorway basis, in order to prevent the landslide,
- drainage of water from the motorway by means of closed, controlled and waterproof system for wastewater collection,
- construction of channels along the motorway for collecting the rainwater and drainage of water from the motorway surface,



- construction of the water treatment facility for the rainwater collected from the motorway surface (separators of oil, lubrication and lagoon if needed, mainly in karst region),
- transport of mud from separators and lagoons to approved landfills
- avoid to use salts and ice-melting solvents,
- measures and procedures of rehabilitation in case of water pollution.

### **Protection of air**

Proposed measures for mitigation/prevention of negative impacts on the air quality are:

- watering of non-asphalt connecting roads,
- covering the trucks while transporting the construction raw materials,
- limiting the speed on non-asphalt connecting roads,
- avoiding «idling» of construction machines,
- using modern and efficient machines,
- designing the soundproof walls that, besides noise, also reduce spreading of emitted pollution substances,
- designing vertical ventilation pipes within tunnels in order to reduce the increased concentration of pollutants at tunnel portals,
- reduction of velocity in the areas with expected larger concentration of pollutants,
- planting of dense leafy vegetation in the area between the road and settlement, in order to act as filtering screen for air pollutants.

During the exploitation period from 2013 to 2042, it is anticipated that the average annual daily traffic rate would increase from 3.20% to 5.60% per year. On the assumption of further development of engine technology in motor-vehicles and of the growing need for alternative fuels, as well as taking into account the stipulated standards of gas emission for new vehicles driven by inner combustion engines, the concentration of pollutants should grow at a significantly lower rate than the average annual daily traffic rate.

### **Protection from noise**

Measures for mitigation of negative noise impacts are:

- reduction of noise transmission by installation of sound barriers,
- reduction of noise emission at its sources (vehicles, smoother motorway surface),
- reduction of noise impacts in settlements by installation of noise-proof windows at certain facilities.

Depending on population density, terrain configuration and expected traffic, one of the three mentioned mitigation measures is being proposed.

Noise limits, and health and safety related issues from tunnel blasting will be managed through the application of BiH laws and regulations for tunnelling operations.

### **Protection of flora**

Anticipated mitigation measures are as follows:

- evasion of especially sensitive and vulnerable areas,
- planning the minimum removal of grass cover as well as the minimum felling of trees,
- preservation of old trees in construction sites, connecting roads and along waterways,
- use of autochthonous vegetation to plant along the motorway and in surrounding areas,
- plant autochthonous vegetation in passages in order to fit into the landscape, enabling the wildlife to cross without any fear or obstacles,
- limit movements of heavy machines during construction, in order to reduce the destruction of surface, that is, use the existing road network which should be rehabilitated after the completion of the construction works,
- after finalization of the works, restore the construction site to its original state,
- build-in surplus of excavation site material into dikes, or deposit it, not to be used for «levelling» the ground within natural vegetation, in order to reduce further expansion of weeds and neophyte species,
- construct slopes along the motorway in such a way as to prevent pulling out of trees on newly formed edges as well as to avoid landslides. This especially relates to tunnels and zones around the posts of the beginning and the end of viaducts,
- carefully handle inflammable materials and open flame, in order to prevent forest fires. Comply with all the regulations and procedures on protection from forest fires. After construction, warning signs regarding limited usage of fire or fire hazard should be placed everywhere,
- when bridging the existing ecosystems, current vegetation should be preserved,
- ensure bio-speleological monitoring over penetration of all the foreseen tunnels on the route,
- regular monitoring of the condition of the vegetation.

### **Protection of fauna**

Anticipated mitigation measures are as follows:

- locate the construction site out of vulnerable areas,
- build passages for animals (small game, fish, amphibians, reptiles),
- build green bridges on locations which are the usual paths used by large game (wolf, bear, chamois),
- build special drainage system near important water ecosystems,
- develop the strategy for protection of underground habitats, to be applied when coming across such habitats (e.g. tunnel penetration),
- plant autochthonous vegetation in passages and on crossings that will fit into the landscape, to enable the wildlife to cross without any fear or obstacles,
- build fence tall enough and fixed in the ground, in order to prevent animals from entering the motorway,

- avoid the use of salts and chemicals for road maintenance in winter months,
- regular and timely rehabilitation of damaged fences,
- regular monitoring of the condition of fauna in the affected area.

### **Protected nature areas**

Protected nature areas will not be endangered if protection measures given in this study are complied with. The nearest to the motorway is Kravice waterfall (LOT 4). Considering the motorway vicinity, as well as permeability of karst and vulnerability of calcium carbonate deposits ecosystems, it is necessary to ensure protection measures in case of accidents. The Buna river spring (1.7 km of distance), the Bunica river spring (1.0 km of distance) and Hutovo blato (3.0 km of distance) are not directly endangered.

Construction of a tunnel through the Prenj mountain, which is part of the future National Park, can be considered mitigation measure in LOT 3 Section.

### **The landscape protection**

Anticipated mitigation measures are as follows:

- watering construction sites in order to reduce dust emissions,
- re-planting of degraded areas with new plants or through agricultural use of land,
- making green strips along the motorway by planting autochthonous vegetation,
- using landscaping on parking and rest locations, central reservation lanes, loops, motels, gas stations and car-parks,
- construction of bridges, viaducts and tunnels at spots where the motorway runs over steep slopes instead of using „cut and fill“ method.

### **Protection of cultural-historical heritage**

The motorway route has been located in such a way as to avoid all registered cultural-historical monuments. Cultural-historical heritage protection measures have been incorporated within the air, water, soil, noise, etc, quality protection measures.

Environmental Impact Assessment Study anticipates the following protection measures:

- after marking out the route, perform the archaeological and conservationist inspection by means of rapid survey method
- inform relevant heritage protection institutions in case of discovering any archaeological findings during the ground works, and stop the works until relevant inspection has been carried out and further instructions by the relevant protection institutions have been given.

### **Measures to reduce, mitigate and/or prevent impacts on population**

Recommended measures are as follows:

- compensation for land acquisition,
- compensation for demolition of houses or farm building,
- compensation to farmers in case of loss of harvest and loss of income because they are unfamiliar with new purchasing and earning conditions,
- compensation for loss of jobs for workers in business facilities that were pulled down along the motorway,
- construction of houses for displaced population,
- reconstruction of houses on the remaining land,
- assistance in finding a new home,
- construction of alternative roads for local population,
- construction of passages in order to connect farms,
- measures to announce and limit movements in case of mining,
- establish safety signalling during the construction phase,
- control of machines and equipment aiming at reduction of noise and emissions of pollutants,
- erecting fence around the construction site.

A special study is being commissioned by the FBiH Ministry of Transport and Communications related to Land Acquisition and Involuntary Resettlement. A Resettlement Framework will be developed that will apply to the full length of the Corridor Vc. This document will be made available to the public.

### **Reduction, Mitigation and/or Prevention Measures on the LOTs**

A summary of significant mitigation measures to be adopted specifically for each LOT are included below:

#### **LOT 1:**

- Agricultural land: reduce loss of quality agricultural land to minimum level; selective removal of humus; replacement property; subways and flyovers for communication between properties; drainage system; closed motorway drainage system; prevention of accidents and efficient response in case of accidents; protective planting.
- Ground and surface waters: positioning facilities in the area of aquifers with high level of ground water; safe drainage of rainwater, grey water and waste water from the construction site; closed motorway drainage system with water filtration devices; collecting oily waters; emergency response in case of accidents; prevent depositing in waterways; adequate disposal of materials and waste; selection of adequate construction materials.
- Trans-boundary impacts: cooperation with the Republic of Croatia' authorities on data exchange, coordination of all necessary activities on environmental protection during the preparation of project documentation, during the motorway construction and exploitation phases.

**LOT 2:**

- Populated areas: avoid collision with populated areas and reduce potential impacts as much as possible; fair compensation in cases of land acquisition; ensure undisturbed traffic during the construction phase; service motorways; water filtration devices; construction of noise-protection walls; re-cultivation of land and planting of protective trees; adequate materials and waste management.
- Ground and surface waters and water supply systems: positioning facilities in the area of aquifers with high level of ground water; safe drainage of precipitations; grey water and waste water from the construction site; closed motorway drainage system with water filtration devices; collecting oily waters, emergency response in case of accidents; prevent depositing in waterways; adequate disposal of materials and waste; selection of adequate construction materials.
- Biodiversity: minimum tree felling, tree felling during the period when birds are not nesting; building passages for large game in areas where motorway crosses their migratory paths; sub-passages for reptiles and amphibians in humid regions; put nets around the construction sites; fences and nets along the motorway; re-vegetation of devastated regions; bird-houses; free passages for fish, etc.

**LOT 3:**

- Protected areas: passing through tunnels; organization of construction sites out of borders of protected areas; bio-speleological monitoring of tunnel penetration; building passages for large game in areas where the motorway crosses their migratory paths; sub-passages for reptiles and amphibians in humid regions; put nets around the construction sites; fences and nets along the motorway; re-vegetation of devastated regions; bird-houses; free passages for fish, etc.
- Excavation sites material: surplus to be built-in into dikes and used for bridges construction; low quality materials to be deposited in surrounding less vulnerable spots and re-cultivated in accordance with the regional landscape characteristics. Snowfalls: organized snow cleaning; selection of adequate locations to deposit drying sand; minimum usage of salts and chemicals.

**LOT 4:**

- Karst area: evasion of extremely vulnerable zones; evasion of water-supply zones; special measures when bridging waterways, additional collection of motorway run-off water in pools and lagoons; organize construction site with special system of protection, especially of waters; collecting oily waters; emergency response in case of accidents; prevent depositing in waterways; adequate disposal of materials and waste; selection of adequate construction materials.
- Cultural-historical and natural heritage: construction works as far as possible from protected area; air, water, soil quality control; material and waste disposal control, especially of dangerous waste; traffic management during the construction phase; cooperation with institutions in charge of protection of cultural-historical and natural heritage; re-cultivation of damaged land, etc.
- Trans-boundary impacts: cooperation with the Republic of Croatia on data exchange, coordination of all necessary activities on environmental protection,

during the development of project documentation, during the motorway construction and exploitation phase.

## **11. Environmental Monitoring**

Monitoring programme comprises tracking of environmental factors during the phases of the motorway designing and planning, construction and maintenance.

A check-list has been used during the designing and planning phase in order to properly consider all potential environmental aspects and problems, and to develop the appropriate protection measures for the project.

A Monitoring plan comprises the following data:

- which parameters are to be monitored/measured,
- where monitoring is to be carried out,
- how to monitor the chosen parameters/type of monitoring equipment,
- when to monitor, regularly or periodically,
- why to monitor the given parameters.

Issues that will be included in the finalised Construction Environmental Monitoring Plan will include the following:

- The zones of special protection, determined by the project, are to be respected and special protection measures are to be adopted.
- Parameters to be followed during the construction phase include enforcement of the adopted protection measures.
- Air emissions
- Noise
- Impacts to surface and ground water
- Impacts on flora and fauna
- Cultural heritage
- Impacts of project affected people and resettlements (mainly through the Resettlement Action Plan)
- Impacts on agricultural land
- Waste

During the Operational Phase the Environmental Monitoring Plan will include:

- Detailed procedures for regular maintenance of the drainage system, security and warning-light signalling
- Rehabilitation following accidents or incidents
- Maintenance of green surfaces.

After the monitoring has been performed, the evaluation/valorisation of results is to be done, followed by proposal on further activities.

## **Environmental Monitoring of the LOTs**

**LOT 1:** Soil quality monitoring; water quantity and quality monitoring; permanent monitoring during construction; cooperation with the Republic of Croatia' authorities on issues of monitoring around the Sava river.

**LOT 2:** Tracking changes of all relevant socio-economic and social parameters; water, soil, air, noise quality monitoring; monitoring of tree felling and re-vegetation; monitoring of game and other wildlife movements.

**LOT 3:** Excavation material quantity and quality monitoring; monitoring of tree felling and re-vegetation; monitoring of game and other wildlife movements; monitoring of snow cleaning and usage of chemicals and sand for melting snow and ice.

**LOT 4:** Soil, air, noise, ground and surfaces waters quality and quantity monitoring; especially of impacts of construction on underground waterways and rivers; material and waste management monitoring; cooperation with the Republic of Croatia's authorities.

## **12. Project Update**

In July 2007, the EIA documentation and public consultation process was formally approved by the FBiH Ministry for Environment and Tourism, and associated permits were issued.

The Public Disclosure and Consultation Plan (PCDP) has been updated and re-issued to comply with the Environmental and Public Information Policies of the European Bank for Reconstruction and Development (EBRD). The PCDP includes the proposed timetable for additional public meetings on the Final Main Design for all four LOTs.

Copies of the Executive Summary, EIA.s PCDP and forthcoming Resettlement Action Plan are available at <http://www.mkt.gov.ba/bos/aktivnosti/vcplan.php>  
<http://www.mkt.gov.ba/hrv/aktivnosti/vcplan.php>  
<http://www.mkt.gov.ba/srp/aktivnosti/vcplan.php>

A copy of the Executive Summary will also be published on EBRD's website at [www.ebrd.com](http://www.ebrd.com).

## Bosnia and Herzegovina: Corridor Vc Motorway Map

