

# REPORT

## ON ENVIRONMENTAL IMPACT ASSESSMENT FOR INVESTMENT PROPOSAL: STROUMA MOTORWAY (SECTION DOOLNA DIKANYA - KOULATA)

### SUMMARY

#### 1. ANNOTATION ON THE INVESTMENT PROPOSAL

Motorway Strouma is of exceptional importance for the national infrastructure. As a part of the international road E-79, it is the most convenient road connection between Bulgaria and Greece. In future, it will provide also the inner road communications between the entire European Union and the Republic of Greece. Its significance is expected to grow higher when it becomes a part of the international corridor N:4, respectively after the future building of the second bridge over the Danube, the Motorway Ljulin and the highway that is planned to connect them.

Motorway Strouma starts in the town of Pernik and reaches the border control station Koulata. Its section connecting Pernik and Dolna Dikanya is already completed. The projects for the remaining sections (M2, M3, M4, M5) are the object of this EIA report.

The respective section of Highway Strouma starts at km.305+220 (village of Dolna Dikanya) and ends approximately at km.439+000 (Border Control Station Koulata). The total length of the section is about 133-135 km (different for different options). The road spreads over new terrain in direction North-South, and coincides with or runs in parallel to the existing major republican road I-1 (E79), with geometric specifications corresponding to a road of higher class and with avoidance of settlements. Road I-1, which is in good condition, will satisfy the requirement for an alternative of the Motorway.

The number of transport facilities such as intersections, bridges, water drain works, tunnels, support walls, high embankments and deep trenches ( >10-15m ) is quite high and there are comments on these in the report. Most of these constructions, together with their main purpose, establish possibilities for undisturbed crossing of the highway, both by people, vehicles, agricultural machines and by wild or domesticated animals.

Designs and calculations of adverse effects in the EIA report are based on the due counting of transport means with corresponding long-term prognosis for development of the highway traffic.

The complex and tight terrain conditions and the relatively low development of the road network in direction North-South do not provide everywhere sufficiently good alternatives for parallel first and second class roads near the highway. For this reason, some of the project design solutions are based on the elimination of the first class road I-1.

The highway bed crosses consecutively few major water courses, as well as their multiple small tributaries. They run close to micro dams, some of which used for water supply. Close to the road beds there are few water catchments, mineral water springs, as well as pump stations. The variants recommended in SEIA do not concern these.

According to the most general assessment, the specific features of the terrain that is freed, respectively will be freed, with the new construction works are those typical for the flat country, with hills and mountains on some spots. A table is attached to this report, to show data on the surface of expropriated agricultural land and forests.

The main raw sources and materials used to build the site will be the natural earth and rock materials extracted in areas where the road is cut through and in special quarries. Apart from these, the site will make use of concrete, steels, asphalt mixtures, isolation materials, fences, etc.

The implementation of the project is related to the possibility to establish conditions for opening of new job places in the adjacent area. This will have a positive effect mostly on the local population. Job places could open also in relation to the service activities on the international road, following its commissioning. Without any doubt, the price of land in the Motorway area will also increase - especially of spots that have potential for establishment of road facilities, such as motels, restaurants, gas stations, car repair shops. The good natural prerequisites could be used as an argument for new economic development, including development of the tourism in this part of the country.

From nature point of view, the execution of most of the project design works must comply with the relative requirements for preservation of the flora and fauna. From economic point of view, construction works related to acquisition of large plots of precious agricultural land should happen at the latest stage possible. This could be a little compensation for the damages caused by the irreversible loss of these plots of land.

## **2. PROJECT DESIGN VARIANTS**

The project designs considered are developed up to the stage of preliminary investigation and consist of four individual parts (M2, M3, M4, M5), which include few variants for each section. The designs are drafted by the companies Spea, Krasi Bo and Votan.

- Project design of Spea - presented as a sequence of variants: RED, BLUE, ORANGE, GREEN, YELLOW, ALTERNATIVE A, ALTERNATIVE B.
- Project design of Krasi Bo - presented with BROWN variant, including some BROWN SUB-VARIANTS.
- Project design of Votan - presented with GREEN and GREEN DOTTED variants only for section M4.

### **SECTION M2 - DOLNA DIKANYA - DOUPNITSA**

- 4 variants developed (Blue, Red, Orange, Brown)

**SECTION M3 - DOUPNITSA - BLAGOEVGRAD**

- 3 main variants developed (Green, Yellow, Brown)

**SECTION M4 BLAGOEVGRAD - KRESNA**

- 8 variants developed (Red, Green, Blue, Alternatives A and B (East of the Kresna gorge), Brown, Green - alternative variant (Votan), Green dotted - alternative variant (Votan)
- **two new variants developed in June 2007 - BLUE AND VIOLET for the Kresna gorge (NSI 2000).**

**SECTION M5 KRESNA - KOULATA**

- 3 variants developed (Green, Red, Brown) with sub-variants.

**3. DESCRIPTION AND ANALYSIS OF COMPONENTS AND FACTORS OF THE ENVIRONMENT. ATMOSPHERE.**

The climate of the region as a major factor of the environment is formed under the impact of radiation, circulation and physical and geographical factors. The quantity and intensity of the solar radiation plays determinative role, as well as its distribution throughout the year. The total solar radiation (TSR) represents the receiving part of the radiation balance equation. Its maximum for the whole region is in the month of July, and its minimum - in the month of December.

Separate sections have different average annual values of radiation balance - they are listed in the EIA report. Special attention is paid to the atmospheric circulation that is described by sections. Detailed data is listed in relation to the duration of sun shining, temperature and humidity of air, rainfall, wind and snow cover. The region is classified climatically. Accordingly, the climate is:

Section **M2 - mild continental.**

Section **M3 - transitional.**

Section **M4 - transitional with clear Mediterranean influence.**

Section **M5 - transitional with clear Mediterranean influence.**

The report on EIA shows data from repeated measurements aimed to determine the degree of pollution of the ground atmospheric air, which will be additionally polluted with contaminants during the construction and operation of Motorway Strouma due to the construction equipment work and car traffic. The state of the component atmospheric air in all measurement points shows pollution levels below the regulatory norms for TLV.

**SURFACE AND UNDERGROUND WATER**

Motorway Strouma is located almost entirely in the river valley of Strouma. The existing road runs along the eastern periphery of the Radomir plain, crosses the valley of Blato river that is a

tributary of the Arkata River, which on its turn is a left tributary of the River of Strouma. At the village of Delyan, the road trace jumps over to the valley of the River Topolnitsa, right tributary of the River of Jerman, which is a left tributary of the River of Strouma. From the town of Doupnitsa to the village of Boboshevo, the highway follows the valley of the River Jerman (along the left valley slope) and then along the state border with Greece (Koulata) - the valley of the River of Strouma - mostly along the left valley slope (depending on the project design variant). In the last section more important left tributaries are the rivers Rilska, Blagoevgradska Bistritsa, Gradevska, Diavolska, Vlahinska, Sandanska Bistritsa, Melnishka Bistritsa and Pirinska Bistritsa, and right tributaries - the rivers Logodashka, Stara, Sushichka, Saparevska, Lebniltsa, Strumeshnitsa.

The water catchment area of the River of Strouma includes the basins of Pernik, Radomir, Kjustendil, Doupnitsa, Blagoevgrad, Simitli, Sandanski-Petrich, the Kraishte mountains (Cherna Gora, Zemenska and Koniavska, immediately fencing the river valley), parts of the border mountains Lisets, Vlahina, Osogovo, Malashevka, Ograjden, Belasitsa and Slavianka, as well as parts of the massifs of Vitosha, Verila, Rila and Pirin. There are two dams on the river of Strouma (Stoudena Dam and Pchelina Dam), which regulate its flow on the upper reaches. In the valleys there are irrigation systems covering small or bigger areas, affecting the surface flow during the irrigation seasons. There are micro dams built on many places in the water catchment basin. They have negligible effect on the overall surface water flow that depends predominantly on rainfall.

The relief of the water catchment basin is predominantly alpine and hollow, with deep faults, strongly indented and formed by the hydrograph grid and glaciers denudation.

The annual amount of rainfall in the West Aegean region varies between 500-550 mm for the Strouma valley from the border to the town of Blagoevgrad, to more than 1200 mm in the alpine parts of Pirin and Rila.

The valley of the River of Strouma is the biggest in South-East Bulgaria and is characterized with soil and geological structure that vary according to the territory; vegetation and diversity of climatic conditions, including strong penetration of the Mediterranean climatic influence. A part of the water catchment in the middle reaches of the river is heavily eroded, but in other mountainous parts is well planted with trees. This predetermines the natural diversity of specifications and regime of the alluvial flow of the main river course and its tributaries. Two big dams exist in the water catchment area of the river - "Stoudena" and "Pchelina"; a multitude of water supply systems and power generating derivations, which hold or distribute some of the alluvial flow of the river. In the basin of Strouma there are many concentrated contaminants of river waters with mechanical admixtures (floating silt) that transfer toxic substances and heavy metals over big distances.

The maximum values of the module of the alluvial flow-off are 3 - 6,7 times higher than the average values for all tributaries, which

could serve as an indicator for the same degree of efficiency of anti-erosion measures, with possibilities for new building.

#### **Quantitative and qualitative assessment of the water resources**

The average annual flow-off of the river Strouma varies between 2,117 m<sup>3</sup>/sec in Pernik to 76,167 m<sup>3</sup>/sec in Marino pole. The intensity of the flow formation changes along the length of the river. Highest flow modules have the tributaries originating from Rila and Pirin, also from the Osogovo Mountain - Sovolianska Bistritsa, and from the Maleshevska Mountain - the river Sushichka.

Due to the climatic influence of the many mountains surrounding the valley of Strouma, its flow-off regime is characterized with 2 minimums - winter (February - March) and summer (September - October). After Krupnik, due to the Mediterranean influence, the minimum flow-off is only in summer. The flow-off of the river of Strouma is formed mainly from the rain and snowfall and/or rainfall, for which reason the correlation  $Q_{\min}/Q_{\text{av.annual}}$  is not bigger than 0,3.

The annual distribution of the surface flow-off of the river of Strouma according to data of water measuring stations at Boboshevo, Krupnik and Marino pole, as well as for the river of Jerman near the town of Doupnitsa for an average (normal) and for a dry year is shown in the graphic attachments.

#### **Category of river currents**

The categorization of the rivers Jerman and Strouma is applied for a few sections - they are 13 for Strouma - from Pernik to the border with Greece. The following parameters are taken into account: mineralization, dissolved oxygen(O<sub>2</sub>) and BOD5, nitrate nitrogen (N-NO<sub>3</sub>), ammonium nitrogen (N-NH<sub>4</sub>) and phosphates (PO<sub>4</sub>), unsolved substances. According to these parameters, the waters belong to I and II category. The report contains diagrams of alteration of respective parameters.

#### **Underground and thermal mineral water**

Considering the sections of the territory crossed by the highway leads to the following findings:

The section within which the existing Road I - 1 (E - 79) crosses the eastern periphery of the Radomir valley is characterised with little water resources. Most spread here are the fissure-veiny waters in jurassic sediments and pores water in low-capacity clayish alluvial deposits of the river Blato and its tributaries.

Practically no water contain the terrains through which the Motorway runs in South direction, up to the intersection for the village of Diakovo. South from there, up to the town of Doupnitsa, it is located on the periphery of the terrace of the river of Topolnitsa, in which small volumes of pore non-pressure waters are formed and linked hydraulically to the river water.

From the town of Doupnitsa, down to the town of Sandanski, most of the highway is located on the border between the terrace of the river Jerman (to Boboshevo) and the river of Strouma (south of

Boboshevo) and on valley slopes formed on the surrounding hills, which contain virtually no water. The river terraces of the river Jerman and the river of Strouma, located in the Blagoevgrad and Sandanski-Petrich basin (the Motorway crosses them along their long side), are the main underground water carriers for the region. While there is no data about the general assessment of the underground water resources on the terrace of the river Strouma relative for the Blagoevgrad river valley, about the Sandanski-Petrich river valley it is known that it contains a definite static reserve amounting to  $140 \times 10^6 \text{ m}^3$ , and dynamic reserve amounting to about  $600 \text{ dm}^3/\text{s}$ . The river terraces of both river valleys and the Simitli valley that lies on a small area in between them have many underground water extraction facilities built on them and used for the local potable and domestic or industrial water supply. The project design of the Motorway does not conflict any of them.

Composition of underground waters in the alluvium: fresh, with low hardness (average of 4 mgequ) and mixed (hydro-carbonate-sulphate-calcium-magnesium-sodium). Near the settlements located entirely or partially on river terraces, permanent areas of contaminated water are formed and drawn along the direction of their movement. They are characterised with complex hydro-chemical structure and regime.

South of the town of Sandanski the Motorway Strouma runs predominantly over Pleocene terrains that practically contain no water, and only at few spots it crosses narrow and low-capacity river terraces of left tributaries of the river of Strouma.

The distribution of underground water along the road of Motorway Strouma is determined by the specific geological-tectonic conditions. The most northern part of the section in question (the river valley of Pernik) falls within the Balkanide hydrogeological region, district Sredna gora. The section crossing Golo Bardo, the Radomir river valley up to the hills next to the town of Doupnitsa belongs to the same hydrogeological region, but to the district of Kraishte, and the remaining part of the road route belongs to the Rila-Rhodopi hydrogeological region (according to the hydrogeological division of Hristo Antonov and D.Danchev).

On the terraces of the river of Strouma and its tributaries there are no-pressure and low-pressure pore underground waters, which are hydraulically connected to the rivers passing in their vicinity. The Tertiary deposits filling the river valleys are carriers of small volumes of pressure layer-pores underground waters.

In the massifs built of carbonate rocks (Golo Bardo, Zemenska and Koniavska mountains) and North Pirin are formed karst underground waters, somewhere in large volumes.

In the silicate terrains of the surrounding mountains are formed cold fissure-veiny underground waters in ignorable volumes.

Many sources of thermal mineral water are located in the catchment area of the River of Strouma (Roudartsi, Kjustendil, Nevestino, Sapareva bania, Blagoevgrad in town and next to the River of Strouma, Simitli, Vlahi, Gorna Gradeshnitsa, Sandanski,

Levounovo, Roupite next to Kojuh (station Gen.Todorov), Marikostinovo, Pravo bardo. In many spots in the rock bed under the Tertiary sediments of the river valleys have been opened by drilling thermal mineral waters, different from the listed above natural deposits.

In the direction of the project design routes of building of highway Strouma, Section Dolna Dikanya down to the border with the Republic of Greece, there are many areas providing possibilities for extraction of potable water, especially those near Blagoevgrad. There are also 13 deposits of thermal mineral water. These are located as follows:

- Thermal water deposit in the area of the town of Blagoevgrad;
- Thermal water deposit in the area of the town of Simitli;
- Thermal water deposit in the area of the village of Oshtava;
- Thermal water deposit in the area of the village of Vlahi;
- Thermal water deposit in the area of the village of Gorna Gradeshnitsa;
- Thermal water deposit in the area of the village of Dolna Gradeshnitsa;
- Thermal water deposit in the area of the town of Sandanski;
- Thermal water deposit in the area of the village of Spatovo;
- Thermal water deposit in the area of the village of Hotovo;
- Thermal water deposit in the area of the village of Levounovo
- Thermal water deposit in the area of the village of Marikostinovo;
- Thermal water deposit in the area of the village of Marino pole, village of D.Spanchevo, village of Chuchuligovo;
- Thermal water deposit **Roupite**.

All deposits of underground water are important and they must not be physically damaged, respectively contaminated by the construction and operation of Motorway Strouma.

All settlements in the water catchment area of the River of Strouma are permanent complex sources of contamination of underground waters, where such exists. The contaminated areas most often include the territories of the respective villages and towns, down in the direction of movement of underground waters, and are characterized with complex hydro-chemical structure and dynamics.

### **3.3. WASTE**

The road in the section of Dolna Dikanya - Koulata is relatively well maintained. Near the lane however, at a distance of about 50-100m, there are local deposits of waste and uncontrolled domestic waste disposals (e.g. near the industrial and resort area of the town of Blagoevgrad and in the proximity of the populated settlements).

In the Kresna gorge, near the natural reserve Tisata, there are larger volumes of domestic waste deposited around the road. After the village of Stroumiani, west of the road, in the river bed, for a distance of 500-600m, waste from marble production is deposited.

Closer to the border with the Republic of Greece, the quantity of domestic waste in ditches along the road grows, especially in the immediate vicinity of the Border Control Station Koulata.

### **3.4. HAZARDOUS SUBSTANCES**

The existing road and the settlements through which the highway will pass are not and cannot be expected to be a source of hazardous substances. As hazardous can be described some of the products transported on the road. The respective permission regime is valid for their transportation.

### **3.5. BOWELS OF THE EARTH**

The geological structure of the region in which the highway Strouma is planned to be built is diverse, at many places complex from construction point of view. The EIA report considers each section of this region. It uses geological engineering (1:100000) and tectonic maps (1:300000), as well as fragments of geological hazard maps. The major geological formations, their stratigraphy, as well as the building qualities of soils and rocks are listed and described in detail. Special attention is paid to the seismicity of the region, especially in the area of the gorge between Krupnik and Kresna, where the strongest ever earthquake in Bulgaria was registered.

Following a request for additional data on natural resources found in the area of project design routes for the Motorway; in August 2007 detailed information about mineral resources fields was received, together with maps of locations of quarries for inert materials and other mineral resources. These are described in the appendix to SEIA. The maps of the surface location of the fields are also attached.

### **3.6. GROUND AND SOILS**

The most wide spread soils within the territory scope of the variants for Highway Strouma are the leaching cinnamon forest soils (shallow, non-eroded or eroded to different degree) and the alluvial soils (alluvial, alluvial-talus, alluvial-meadow, alluvial-talus-meadow, marshy), followed by lythosoils, regosoils, rankers, rendzines, alkaline soils, brown forest soils, light soils, soils with secondary grassing. These are described separately, together with data about their composition and other parameters. The condition of the soils is also characterized. Some of the most



typical degradation processes are considered (according to the classification of damaged soils) as relative for the soils of the respective territories, such as: water erosion, alkalization, excess humidity - swamping, dehumification.

The long-term purpose and use of the territory is also considered (fields, vegetable gardens and orchards, vineyards, natural meadows and pastures and non-cultivated land), together with the hydro-melioration systems (irrigation and draining systems) built in the area of the project design variants for the assessed site.

### **3.7. VEGETATION AND ANIMALS**

#### **3.7.1. FLORA**

##### **Section M2**

The routes in question pass through the mild continental climatic area of Bulgaria and through a part of the Highlands of West Bulgaria. The vegetation corresponds to the climatic features of the area. In the section Dolna Dikanya - Doupnitsa the road passes through antropogenous phytocenoses - pine trees, cultivated lands, orchards and meadows. The description of these formations is based on data contained in related literature and immediate investigations of the terrain of the proposed routes.

##### **Section M3**

The route of the Section Doupnitsa - Blagoevgrad falls within the South-European type of vegetation, with mediterranean steppe and mid-european elements. The vegetal formations have almost disappeared under the impact of the human activities. Artificial eco systems are created and heavily affected by the human activity - coniferous cultures and agricultural areas (cultivated land, meadows, orchards and vineyards). South of Blagoevgrad, around the river of Strouma there are few marshy areas with typical vegetation. These are important as ornitological areas and have their respective conservation significance.

##### **Section M4**

From Blagoevgrad to Simitli, the project routes (brown, green, red variants) pass through heavily modified by men vegetative formations - cultivated land, tobacco fields, vineyards, orchards, coniferous cultures (*Pinus nigra* L.) of IV- V estimated productivity on shallow eroded soils.

In the beginning, the variants pass through the Natural Protected Area "Oranovski prolom - Leshko" BG 0001032, and exit the area at km. 371+600. From km 382+000 to the end of M4 the route passes through NPA «Kresna» BG 0002003, NPS "Kresna-Ilindentsi" BG 01000366 and the natural reserve «Tisata».

The alternative routes pass through deeply crossed areas with strong slopes with big displacement of levels, run through partially preserved and strongly modified - under the antropogenic

pressure, vegetative formations. At some points the routes cross former arable land that are now covered with orchards or secondary formed frutescent groups, including Junipers excelsa and Juniperus oxycedrus. There are some single preserved groups and samples of black pine, durmast, woolly oak, etc. The Green Alternatives are in located in the immediate vicinity of the borders of the National Park Pirin. The natural phytocenoses are strongly affected by human activity, and the terrain in most cases has high erosive activity.

The tunnel variants presented in June (NSI-2000) are in fact a further development of the Green Variant of Spea in the region of the Kresna gorge. They are designed with long lengths of tunnels and developed in the massif of the Malashevskia Mountain. They run under the protected area Tisata and do not result in any changes to the environment.

### Section M5

The site under consideration falls entirely in the Middle Strouma sub area and covers the valley located in between Osogovo and Belasitsa to the West, Rila and Pirin to the East. In this part of the country, the Mediterranean species form specific phytocenoses. Most interesting are the vegetative communities of Pistacia terebintus, Juniperus communis, Paliurus spina-christi, Platanus orientalis, etc. The Bulgarian and Balkan endemits are with low presence, however the number of rare species that could be found only here is quite big.

The field studies and the analysis of specialized literature show that the primary character of the nature here is strongly modified by the human activities, and the natural vegetation is replaced with forests and agricultural species, especially to the South of the Kresna gorge. The root vegetation, as a result of the developing agriculture and stock-breeding, is replaced with its derivatives, most of them grasses. The bigger part of the natural vegetation groups are heavily degraded, and some other are endangered with destruction. South of Kresna, the designed road according to almost all variants passes almost entirely through anthropogenic culture eco-systems - vineyard massifs, orchards, forests, meadows, which from ecological point of view are equally important.

All described types of partially preserved natural phytocenoses are separated with plots of arable land and plantations of perennial plants. Significant re-distribution role was also played by the railways and the road existing in the gorge, the grazing, tree felling and other activities.

The great biodiversity and the exclusively interesting vegetative formations with high conservation significance are the reason to form the following protected areas in the land attached to Section M-5 of highway Strouma: NPA Kresna Bg 0002003; NPA Kresna-Ilindentsi Bg 0000366; PA Kresna, PA Моравска; NPA Ograjden-Maleshevo Bg 0000229; NPA Roupite Bg 0002098; NPA Roupite - Stroumeshnitsa Bg 0001023. Some of the variants are designed in such a way that they will affect only parts of the mentioned areas.

Except for one, all proposed variants plan for the Motorway Strouma to pass far to the East from the protected area Moravska.

For each section data about contaminants are quoted, such as lead and cadmium in the vegetation, proved with previous measurements. They show that the surveyed heavy metals are below the sanitary norms.

A list of protected, rare, endangered and endemic vegetal species in the area of the Kresna gorge is presented, together with their national and international natural protected status. The list shows that the floristic composition of the Kresna gorge, according to Nature Protection Act, there are 19 vegetative species with status of strictly protected; the rare species, according to the Red Book of Bulgaria are 35; the endangered species are 6; the Balkan endemits are 22, etc. The species included in Appendix 1 to the Bern Convention on Protection of the European Wild Flora and Fauna are listed, together with their natural habitats and those included on Appendices IV and V to Directive 92/43/EEC of the European Council of May 1992, for protection of natural habitats and wild flora and fauna.

Kresna gorge is treated as territory Corine sites.

A detailed description of the Natural Reserve Tisata and data on the condition of vegetation in it are provided.

### **3.7.2. FAUNA**

The fauna in the area of site location, including the vertebrates that is best studies and which natural protected status is best regulated in Bulgaria, belongs to types characteristic for the valley of the river of Strouma and its surrounding mountains. From zoographic aspect the fauna belongs to the Palearctic type, more specifically consists of species typical for the mild geographical latitude, however in the district there are a big number of species with southern occurrence in Europe, i.e. with areas of habitation in the Mediterranean sub area of the Palearctic.

We need to say that for this part of Bulgaria, due to its geographical position that determines its climate (which acquires more Mediterranean features the more South you go), is typical not only the unique for the country flora, but also unique for the country fauna. Both the vegetation and the animal world show adequate for the climate change from Middle European to stronger Mediterranean character of the groups, and with bigger biological diversity as a whole. An investigation carried out in 1989 - in the end of May/beginning of June, proved that the dominating ornitho-complex of species in the valley of the river Strouma (the river bed and the territories attached to it) that in the area belonging to the Pernik region included only species with Central-European occurrence, near Sandanski had as most numerous species the nesting little olive mocking bird - a species with clearly expressed Mediterranean positioned area of habitat.

The district of the Strouma valley was visited many times in different years, across its whole length from the district of Pernik to the border with Greece.

Due to its unique biological richness, this region of the country must be protected to the maximum possible degree, including precise assessment of activities affecting it, even of those that could change the environment to a minimum degree.

The fauna in the region (of the respective sections of the highway) of the site - the valley of the river Strouma and the surrounding mountains, also around and inside populated settlements, can be specified as follows:

### **Section M2**

List 1 is attached for that section of the highway, for which are typical 216 vertebrate species (without fishes and bats), among them 5 amphibian species, 14 reptiles, 161 species of birds, 36 species mammals.

The species of List 1 included in Appendix 2 to the Law on the Biological Diversity (of endangered species of plants and animals with priority protection) are quoted in List 1a. This list shows that from the typical for this section of the highway species, Appendix 2 includes 61 vertebrates (exclusive of fishes and bats), among them 1 amphibia, 2 reptiles, 51 birds and 6 mammals.

There are no protected territories and objects of the animal world near the site in SECTION M2, which could be affected by the construction works and the operation of the road route.

### **Section M3**

Appendix 2 is a part of the EIA report and it covers the typical and predominating animal species in this Section. As indicated on List 2, typical for this section of the highway are 235 vertebrates (excl.of fishes and bats), among them 9 amphibians, 15 reptiles, 173 birds and 38 mammals.

In the rivers of the region, most of all in the river of Strouma that is the main water course determinant for the appearance of this part of the country - as the valley of a big river with significant length, it is possible to find many types of fish.

Of course, the biggest fish resources belong to the river of Strouma.

List 2a presents the endangered vegetation and animal species, which preservation is a priority according to the Law on Biological Diversity. It includes 63 vertebrates (excl.of fish and bats), of them 2 amphibias, 3 reptiles, 52 birds and 6 mammals.

### **Section M4**

Oranovski gorge and Kresna gorge - List 3. According to this list, typical for Section M4 of the highway are 264 vertebrates (excl.of fish and bats), of them 10 amphibia, 21 reptiles, 193 birds and 40 mammals

Species from List 3 included in Appendix 2 (endangered vegetation and animal species, which preservation is a priority according to the Law on Biological Diversity) are shown on List 3a. It shows that - from the typical for this section of the highway species, Appendix 2 includes 74 vertebrates (excl. of fish and bats), of them 3 amphibians, 5 reptiles, 60 birds and 6 mammals.

There are also details about what is the Kresna gorge in terms of natural diversity and its location as the most northern well-formed site on the valley of the river Strouma, where many vegetative and animal species with southern areas of habitat for the continent of Europe are found. The great and unrepeatable bio-diversity of the Kresna gorge leads to the conclusion that the respective section of Motorway Strouma that could pass through this area should be designed, implemented and used in a way that could cause minimum effect on the flora and fauna of the adjacent territories.

On grounds of a written notice by MEW about the necessity of additional information for Part Fauna, a list of Habitats of birds included in the eco-network Natura 2000 was requested and submitted, as well as updated maps of NPAs. They are attached in the additional information to the EIA report. Also attached to the EIA are:

- List of nesting birds in the area of the Kresna gorge, with their national and international natural protection status (drafted by Georgi Stoyanov and Radoslav Stanchev);
- List of types of bats found in the Kresna gorge, with notes about their natural protected status (drafted by Boyan Petrov).
- List of reptiles and amphibians found in the region of Kresna gorge, with their national and international natural protection status (drafted by Deyan Douhalov);
- Statement on the building of a highway in the region of Kresna gorge, between the towns of Simitli and Kresna (drafted by Andrey Kovachev and Alexander Kodjabashev)
- Statement by the Bulgarian Society for Bird Protection, regarding the International Significance of the Ornithological Place Tisata, Kresna gorge for Bird Protection.
- Some additional explanations are provided by the expert Eng.D.Kjuchukov.

### **Section M5**

Attached is List 4 that visualizes the typical and dominant animal species in this part of the country. For the section of the highway are typical 270 vertebrates, of them 10 amphibians, 23 reptiles, 197 birds and 40 mammals.

The species of List 1 included in Appendix 2 to the Law on the Biological Diversity (of endangered species of plants and animals with priority protection) are quoted in List 4a. This list shows that from the typical for this section of the highway species, Appendix 2 includes 75 vertebrates (exclusive of fishes and bats), among them 3 amphibians, 6 reptiles, 60 birds and 6 mammals.

The fauna in the scope of the whole site Motorway Strouma between Dolna Dikanya and Koulata can be characterized in the following manner: due to the specific features of the relief, climate, geological base and heavy erosion of a big part of the terrain, i.e. due to the big diversity of habitats this region of the country disposes with rich vertebrate fauna (with big diversity of species), with strongly expressed individuality. As visible from Lists 1, 2, 3, 4, in direction North-South (i.e. for the specified 4 sections of the highway) the number of species (excl. of fish and bats) constantly grows and is respectively 216, 235, 264, 271 species. This growth accounts most of all for the increased number of species of birds and reptiles, but also of amphibians and mammals. Even if to lower degree, such increase is also valid for the species of Appendix 2 of the LBD - in the same order: 61, 63, 74, 76 species, which could lead to the conclusion that the regions where each of the 4 sections of the site are located вида, are rich in many species with priority for preservation.

### 3.8. LANDSCAPE

The EIA report provides also description of the main features of the structure and functions of landscapes in the area under consideration.

According to the regional landscape division of the country (Prof.M.Georgiev, Structure and Dynamics of Landscapes in Bulgaria, 1977), the territory of the proposed variants for a route falls within the scope of the South-Bulgarian mountain-valley district, with the following sub districts and areas:

1. Sub district Kraishte, with areas: Breznik-Pernik, Ljubashko-Pernik, Ljubashko-Verila, Radomir and Milevsko-Koniavski;
2. Subdistrict Osogovo - Middle Strouma, with areas: Middle Jerman, Pogled-Vlahino, Malashevski;
3. South Strouma with areas: Kocherinovo-Simitli, Ograjden, Belasitsa, Strumesh-Strouma;
4. Subdistrict Rila with area: South Rila;
5. Subdistrict Pirin with area: West Pirin.

EIA provides detailed information on each area, types and subtypes, groups and classes of landscape. It also outlines the criteria for their division into natural and anthropogenic.

According to the assessment, within the scope of the designed routes there are no entirely preserved primary landscapes, and that refers also to the natural reserve Tisata - North of Kresna, and to all sites proposed by Natura 2000.

The report underscores that all variants for routes establish possibilities for frequent change of sights with different visual scope. Regardless of the chosen variant, the close and middle range visual scope include that adjacent to the highway green areas, rivers and streams, rocky formations (in the narrow sections), agricultural plots and settlements. The far visual scope in different sections of

the highway includes impressive views towards the neighboring mountains and individual natural amenities.

### **3.9. HARMFUL PHYSICAL FACTORS - NOISE**

Currently, the major source of noise in the region of the future highway is the traffic on Road E-79. A representative noise specification of the traffic for 2006-2007 (equivalent noise level  $Leq$ , dBA) is determined on basis of calculation methods using data from the general profile counting carried out by EA Roads.

The material provides also results from measurements of noise carried out in real conditions in populated area located around the existing road and different variants for routes of the future highway.

### **3.10. HEALTH AND HYGIENE ASPECTS OF ENVIRONMENT**

Data is provided regarding the potentially affected population and territories, areas or sites with specific hygiene and security status or subject to health protection, depending on the territory scope of the effects on the environmental components. The risk factors for damages on people's health are identified too.

The main risk factors for the health of workers involved in the implementation of the investment proposal here are the dust, toxic contaminants, noise, general and local vibrations, adverse microclimate, physical loading.

Hazardous factors for people's health during the building and operation of the highway will be mainly the polluted air and excessive noise levels.

From the chemical hazard factors in terms of composition of substances main importance have the following: polycyclic aromatic carbohydrates (PAC), heavy metals, carbon and nitrogen oxides, sulphur dioxide, tars, etc.

Below is provided short specification and description of separate factors in relation to their impact on human health and their correspondence to currently valid hygiene norms and requirements.

#### **Harmful physical factors:**

- Adverse microclimate
- Excessive noise levels
- Excessive general vibrations levels
- Local vibrations
- Dust

#### **Harmful toxic-chemical factors:**

- Carbon oxide
- Sulphur and nitrogen oxides
- Traces of cadmium and lead from unleaded benzenes

#### **Physical loading factor**

Data have been collected and the health condition of population

residing in the region has been analyzed. The study covers the health status of the population of municipalities Radomir, Doupnitsa, Kocherinovo, Blagoevgrad, Simitli, Kresna and Sandanski, using demographic parameters and comparative analysis against the indices typical for the whole country.

The major demographic indices have been studied separately for the population of the above mentioned municipalities and generally for the whole population of the country. The information is tabulated in tables. Parameters indicating children mortality, general mortality, birth rate and natural increase of the population have been analyzed for the municipalities and for the whole country.

A detailed investigation of the index mortality rate was applied by cause of death and the results obtained for districts Kjustendil and Blagoevgrad were compared with data valid for the whole country for the period 2002-2004. The research covered 17 classes of diseases, including cancers and similar to them diseases.

The indicated parameters from the tables have average values when compared to the standards contained in different literary sources. No such standard indicators groups have been developed for our country, neither for general indices, nor for nosology groups, and this makes the comparison difficult. It is noticed that the values for district Kjustendil can be compared to those typical for the population of the whole country, however the values for district Blagoevgrad are considerably lower and present the district as one characterized with the lowest rates of oncological diseases for the country as a whole, which is definitely a positive fact from health and hygiene point of view. There is no data about increased rate of oncological diseases occurrence as a result from the harmful impact of environmental factors.

### **3.11. MATERIAL AND CULTURAL HERITAGE**

The report on EIA relative for this part of the country starts with information about old roads in the valley of the River of Strouma. Geographical maps and historical sources data are presented, thus leading to the conclusion that the region where Motorway Strouma will be located is a historically established and geographically and economically confirmed route used by the people from the remote past till nowadays.

Also provided is a catalogue of the most known and with archeological value sites in the range of the road routes. The archeological monuments are listed by settlements of villages, ordered from North to South. Their number exceeds 100, which means that in the course of the future construction works some new archeological sites could be discovered.

## **4. PRESUMED SIGNIFICANT IMPACTS ON THE POPULATION AND THE ENVIRONMENT**



#### 4.1. ATMOSPHERIC AIR

To determine the level of pollution according to the European standards and the respective Bulgarian legislation, the report used a Methodology for determination of the dispersal of harmful substances emissions from road vehicles and their concentration in the ground atmospheric layer - software product TRAFFIC ORACLE, module DIFFUSION. It provides statistical or typical assessment of the levels of pollution with a specific pollutant.

The construction stage is generally limited in time and will not affect considerably the quality of atmospheric air. The prognosis and respective recommendation for selection of variants is made on basis of gas and dust emissions from construction equipment, emissions of fine dust particles, unpleasant smell of substances used in the course of building, where the prognosis for the harmful emissions during operation is added.

The assessment of emissions of vehicles on the already constructed Motorway Strouma is based on data from counted vehicles and corresponding long-term prognosis for development of the automobile traffic quoted in details in Section 1.2 of EIA. The conclusion is that in principle the traffic on the Motorway Strouma will contribute a little to the emissions of these pollutants in comparison to emissions from populated settlements. The study takes into account the results from measurements of concentrations of separate pollutants on the existing Road E-79.

The comparison of data from measurements shows that the anticipated concentrations of studied pollutants in general preserve their levels.

The report gives the following assessment and grading of different variants for situational solution for the highway route on the four main Sections on highway Strouma, as follows:

- **M2** - Dolna Dikanya - Doupnitsa - variants **Red and Brown**;
- **M3** - Doupnitsa - Blagoevgrad (South)- variants **Brown, Yellow, Green**;
- **M4** - Blagoevgrad (South) - Kresna (North) - **Brown, Red, Green** additional **BLUE VARIANT** of "NSI-2000";
- **M5** - Kresna (North)- Koulata - **Brown, Red and Green**.

With the building and commissioning into operation of MH "Strouma", the pollution on the existing Road E-79 are expected to decrease significantly, as the transport traffic will be transferred to the highway, the average speed of driving with thermally stable engine operation mode will increase, which on its turn will decrease the volume of emitted harmful substances. Eventually, this will improve the hygiene parameters of the atmospheric air in the settlements.

A certain problem to be solved will occur in the Kresna gorge, where the ventilation of tunnels will create a series of spot sources

of air pollution. The locations of these sources (ventilation shafts) and their parameters are not specified and presented in the project design of NSI-2000 submitted for assessment, as well as the technology of the actual process of ventilation. The recommendation of SEIA is to allow sufficiently dense distribution of ventilation facilities in order to avoid the concentration of harmful gases. The recommended distances are of the range 100-150 m.

In the above grading of variants for Section M4, the Red and Violet variants line up with the Green variant of Spea.

## **4.2. SURFACE AND UNDERGROUND WATERS**

### **4.2.1. SURFACE WATER**

#### **Sources of contamination during construction**

The building of Motorway Strouma can cause only temporary and localized increase of the turbidity of the river Strouma and its tributaries in the sections where bridges, culverts or supporting walls are built. This turbidity will be of mineral origin and will be related to excavation and embankment works near culverts and ravines, only when water runs through them. This cannot change the category of rivers as receiving streams.

#### **Sources of contamination during operation**

The transport traffic during operation will be a linear source of contamination coming from:

- used gases of car engines, aerosols, soot, etc. from passing vehicles and from tires wearing on the road lanes;
- inorganic contaminants of the type of salt and lye used to prevent freezing of the road surface;
- sudden contamination in cases of spilling of dangerous substances transported on the road.

The building and operation of the road does not suppose discharge of waste water that must be collected and treated. The road will not affect visibly the regime of surface waters; only minimal increase could be expected from rainwater draining off the road lanes to the nearby gullies.

Emitted gases, aerosols and soot from vehicles driving on the road are contaminants with continuous action and along the whole length of the road, but with alternating intensity and very little influence. The above mentioned contamination with salt and lye is seasonal and along the whole routes, however its intensity is low.

Most serious but impossible to foresee and prevent is the 100% bursting contamination that could be the result of a break-down spilling of petrol derivatives or other hazardous substances. The probability of its occurrence is difficult to assess.

## **SURFACE WATER CONTAMINATION HAZARD SECTION - M2**

From Dolna Dikanya to Doupnitsa least risky is the Brown variant, with the peculiarity that in the far route circle that this variant plans west of Doupnitsa the Red variant has some advantages. Lowest risk variant for the Section near the dam of Dyakovo is the Brown variant. This assessment can be valid for the whole Section M2 in general.

In relation to the necessity to protect the water of Dyakovo Dam from break-down spillouts, it is recommended to build 1km of protective wall and concrete ditch parallel to the road.

### **SECTION - M3**

As far as the water currents contamination is concerned, most safe for the open water courses is the green variant. The yellow variant is next in safety, it is closer to the open water course, passes through plane terrain, but crosses a bigger number of small tributaries.

The brown variant, especially Brown Dotted I and II are not recommended from the point of view of preservation of surface waters. These variants are located too close to the water currents and additionally increase the risk of their contamination.

### **SECTION - M4**

Most conservative for the surface waters in general is the Red variant, followed by the Blue variant (closer to the River of Strouma). The brown variants is more unfavorable than the other two due to the many points of bridging and corrections of the River of Strouma, as well as the Green variant that crosses many sanitary protection areas of water catchments for the surrounding villages.

### **SECTION - M5**

Best for the surface waters is the Green variant that is most distant from the bed of the River of Strouma. Second place holds the Red variant that has little approach to the surface water course.

Most adverse for the surface water is the Brown variant with all its sub-variants, because of the frequent bridging of the river, as well as the long corrections of the river bed. The proximity to the River of Strouma means potential hazard of break-down contamination of the water caused in accidents involving auto-tanks, and due to the proximity to Greece - potential danger of trans-border contamination.

The variants described by sections define the road as average to highly hazardous for the surface waters, especially if a dangerous failure occurs at the time of high tide.

The preservation of the surface water flowoff is an inseparable part of the protection of this water. In this sense the present report on EIA does not support the implementation of any corrections to the rivers Jerman and Strouma. This is also applicable to the problems with allowing road routes to enter the river beds and thus eliminate some of the existing wet areas. Such areas exist nearly along the full length from Doupnitsa to Koulata. This report on EIA does not promote the variants designed to include the wet areas on the river valleys, especially near Blagoevgrad and south of Kresna.

#### **4.2.2. UNDERGROUND WATER**

The negative impact of facilities similar to Motorway Strouma on the underground water can appear mainly during the building stage. It results in the physical destruction of springs, water catchments and wells, drying of territories, as well as limitation of the access of people and animals to them. On the approximate highway length of 135 km, there is a multitude of water springs and catchments that are potentially endangered with destruction. Not including the small, characterized with irregular flow (even drying seasonally) springs, the main threat to the underground water is the crossing through SPA, especially through those in immediate vicinity to belt A of these areas.

Out of the road route variants presented for consideration and ecological assessment, the brown dotted lines near Blagoevgrad must be regarded as unacceptable, as they pass through and by the water supply areas of the city.

Alternatives A and B of Spea, respectively the alternative green variants of Votan are also not recommended in relation to the preservation of surface water, as they pass through many natural springs and few water supply areas for potable and domestic water supply approved and legalized with SPA.

Along the direction of the project design routes for highway Strouma in the section from the village of Dolna Dikanya to the border with the Republic of Greece there are also many thermal water springs, which are very important natural resource and their preservation should be of utmost importance for the choice of the final route variant. The proposal for choice of a route variant provides a combination that does not affect mineral springs and water supply facilities.

#### **4.3. TYPE AND QUANTITY OF WASTE**

##### **AT THE STAGE OF CONSTRUCTION**

Large quantities of excavated materials, including humus, will be produced at the stage of building of the highway. All the excavated volumes will be kept till the end of the building works, and will be then used for the re-cultivation of slopes, service roads used at the stage of building, construction sites, etc. The quantity of humus replaced at the time of building cannot be specified before the technical project design is submitted, with the route already placed on the terrain. During the construction works certain volumes of waste will be generated too - building materials (concrete, asphalt, isolations, steel, etc.). In the course of work with road construction equipment, with their operation, maintenance or repairs,

it is probable that waste will be generated too. There will also be the respective quantity of domestic waste.

The quantities of building waste could be significantly decreased with the respective control over the construction works.

#### **DURING OPERATION**

The road as a facility does not generate waste after the completion of the construction works. In the course of road operation there will be waste constantly deposited in the area surrounding the road or in the ditches, most of it will be domestic waste thrown out by passing cars or parts of vehicles and equipment left after their emergency repairs. These will not be large in volume or dangerous, and could be regularly removed and cleaned.

A feature of the construction works pollution and road operation is the possibility for quick and easy removal of pollutants. Collection and transportation of waste generated with different types of construction activities and later with the road operation shall be organized respectively by the builders and the services maintaining the motor vehicle road.

#### **4.4. HAZARDOUS SUBSTANCES**

The road as a technical facility cannot be considered a source of hazardous substances contamination. A problem with the latter could occur during its operation, when there are traffic accidents and break-downs of cargo vehicles (most often spillouts from tanks) transporting substances of the respective classification. The probability of occurrence of an accident with dangerous waste is small; however it can appear any moment and in any section of the road.

#### **4.5. EARTH BOWELS**

The big infractions of the geological medium can be expected mainly on the stage of building, when the major works for excavation of deep trenches, high embankments, tunnels, support walls, bridges and other facilities will be carried out.

One of the major alterations to the geological medium to be expected is the change of its stressed state. It will be caused by the effect of the additional loading (e.g. for embankments) and unloading through excavations in depth. Of special importance will be the planned result from the digging of tunnels. All these construction works not only will use powerful heavy excavating, transporting and compacting equipment, but will involve explosions.

Another change to the geological medium is the expected activation of landslides and land collapses, especially if the construction works are not based on good surveying and do not take into account the geological peculiarities. We should add to that the possibility for activation of the processes of weathering and erosion that normally go along with this type of building.

It is possible to expect negative geological alterations caused by the necessary in this case disposals of earth and rock materials and from reciprocal excavations. The latter are needed for the implementation of the planned large-scale and large-volume dump works. We should not underestimate also the necessity to use quality construction materials (predominantly rocky) for the road covers.

### **Section M2**

Between the village of Dolna Dikanya and Doupnitsa, the excavation works differ in volume for different materials proposed. Best parameters show the Brown variant that is designed to follow the terrain line to the maximum possible degree.

It is accepted that the quarry construction materials will be delivered from few quarries in the district of the town of Pernik: Vladaya, Kladnitsa, Marchaevo, Malo Bouchino.

A peculiarity of this Section is the danger for establishing prerequisites for intensive erosion in the area of affected terrains and around them (including service roads and sites).

### **Section M3**

Neuralgic for this Section is the area around Doupnitsa. The route of the existing road that will become a part of Motorway Strouma has suffered for many years from old landslides that have not been eliminated. The laying of a highway route there, as proposed by the Green and Yellow variants (both belong to the company Spea) will become the basis of a serious geo-technical problem which solution is difficult to prognosticate. The same refers to the orange variant, which also plans for a tunnel crossing inside a massif west of Doupnitsa that is proved to be unstable.

The brown variant that travels far to the west to go around Doupnitsa does not present problems as those outlined above, however it will probably need to make deep slope cuts and solving complex problems with the resistance of the cut under (earth and weathered rock) slopes and the control of the surface erosion. The route at some places is exposed to North, so it will partially adversely positioned against the sun shining, which will lead to the well-known difficulties with the winter operation.

For this Section it is planned to search for a possibility for the materials to be used for embankments to be obtained from the excavations and to use quarries located in the area for rocky and inert materials.

The quarry located between the villages Slatino and Boboshevo is specified as the place from which auxiliary materials for concrete (sand and gravel) will be obtained. Some other quarries for rock materials are specified - those in Delyan, St.Lisichkovo, Vulkovo, Jerman, Stroumsko.

It is not possible to accept without good consideration the specified in project work designs "extraction of supplementary materials on the alluvial terrace of the River of Strouma".

All active quarries for extraction of inert materials in Section M3 are described, and SEIA includes the studied and proved available volumes (reserves) and the concession for their extraction. The precise location of each quarry is specified on the map.

The designing of Motorway Strouma was carried out without taking into account the existence of open quarries and the proved reserves of mineral resources. For this reason, in some places in Section M3 there are routes that do not correspond to the location of quarries for extraction of mineral resources:

- Field "Boboshevo" (inert materials) - not affected by the project design variants;
- Field "Kocherinovo" (inert materials) - partially affected by the recommended Brown variant; the route of the gas pipeline to Greece goes through this field;
- Field "Poletto - North" (inert materials) - not affected by the road routes considered;
- Field "Poletto" (inert materials) - a link between the Brown and Yellow variants is planned in the vicinity - this should be taken into account at the design stage; it may not be affected by the Motorway Strouma;
- Field "Gyolo" (inert materials) - crossed by the Brown Dotted line; not affected by the recommended Brown road route;
- Field "Blagoevgrad" (inert materials) - crossed by all developed variants; most conservative is the recommended in SEIA Yellow variant (which is practically on the tangent of the field);
- Field "Vlashka chouka" (clays) - not affected by the project design variants.

#### **Section M4**

From geological point of view this Section is most complex. It includes a number of problematic zones, one of which is in the beginning of the route where it shall exit the Blagoevgrad valley and enter the Oranovski gorge. The plan includes tunnels, deep trenches and high embankments. Here the presented variants - Green and Brown, are equal in value. The Red variant is definitely more conservative for the geological medium.

A few alternative variants are presented for the next Section - Kroupnik - Kresna (Kresna gorge) - Blue (Zero alternative) and four alternatives that for the purpose are situated east of the gorge, running along the high parts of the Pirin skirts.

From geological point of view these variants are absolutely unacceptable, especially taking into account that they suggest large facilities - bridges and tunnels. The area east of the Kresna gorge is heavily fractured, a big part of the medium in which the building is planned to concentrate consists of earth masses pulled down in the big earthquake in 1908. The building of facilities there requires something more, because of the cross-country relief: a

system of temporary service roads, works sites at every bridge support, large excavations and disposal of big earth and rock masses. This will cause extremely big erosion. In these conditions the transport facilities will be very difficult to use and unsafe for operation.

According to the Red and Brown variants presented for assessment, the construction works in the gorge will involve some sensitive excavation and embankment works and again too many pieces of equipment and facilities. Without doubt, they will change quite negatively the face of the gorge and that is why they cannot receive a positive comment. Also significant is the fact that the valley of the river of Strouma lies on a deep seismogenic fault, which makes difficult the foundation of the bridge facilities and the operation - insecure.

The other two variants - Blue and Green, can be considered as possible for implementation, but nevertheless they cannot be definitely recommended. The blue variant plans for extension of the road clearance, which is again related to excavation and embankment works, while the Green variant is located under the slope of the Maleshevska Mountain. Here the tunnels can be constructed and the excavated rock materials are suitable for use in the road body outside the tunnels. This variant however should be précised and as to date it can only be considered as a good prospect for the investigation stage.

Quarries planned for in the project designs: Kroupnik and Kresna.

Mineral resources found in the vicinity of the route of Motorway Strouma:

- Deposit "Simitli" (uranium ores) - it is crossed by all variants that coincide with the existing Road E-79; geotechnological operation without extraction; the project design routes use new space only for the duplicating lane of the MH.

### **Section M5**

In this section the variants can be assessed as of equal value from geological point of view. Many sub variants are presented here.

It is not possible to support the idea of taking the route out, to the east of Dolna Gradeshnitsa and affecting the earthen pyramids there.

The Red variant seems to be more convincing among the other variants from geological disturbances point of view. The other two - the Brown and Green variant, are comparable and could also be implemented.

Everything said about the erosion for the last sections remains valid.

It is unacceptable to recommend without criticism the use of materials for reciprocal excavations from the bed of Strouma - something that the project designs lie on.

Active quarries: Kresna, Damianitsa, Sklave, Logodash.



Mineral resources found in the areas for which the project designs are developed:

- Field "Gradeshnitsa" (uranium ores) - underground подземна operation without extraction; crossed in part by the Brown variant; the recommended Violet alternative is developed in parallel and immediately next to the existing road and the railways, where mineral resources will not be extracted.
- Field "Valkovo" (extraction of inert materials) - remains far away and is not affected by the recommended Green variant.
- Field "Damyanovo" - (inert materials) - no extraction. Stays far away and not affected by the recommended combination of Green and Brown variants.
- Field "Pripechene" (uranium ores) - underground operation without extraction; crossed by the recommended Brown variant that is developed in parallel to and immediately next to the existing road and railways, where no mineral resources will be extracted.
- Field "Drangovo" (inert materials) - no extraction. Stays far away and is not affected by the recommended Brown variant.
- Field "Melnishka reka" (inert materials) - no extraction. Not affected by the recommended Brown variant.

#### **4.6. LANDS AND SOILS**

##### **During construction**

The soils under the road lanes will be completely destroyed. In the adjacent stripes sidelong of the road lanes, up to 50m wide, the soil profile will be damaged as a result of the excavation and embankment work and the respective construction and installation works.

The maneuvers of the transport and road machines will lead to secondary compaction of the soils in the area of their activities (temporary roads, temporary construction sites, surroundings of earth depots, building and inert materials).

It is expected that the damages from the erosion processes caused by the disturbed soil profile will not be big, as the width of the affected sidelong stripes will not be big. Apart from this, a large part of the highway built in an embankment, transversely to the slope, will shorten the length on which the erosive water flow will be formed and thus will decrease its erosive and transporting power. In these cases however, it is very important that the water culverts are properly located. The water erosion will be a danger mainly for the cuts of the embankments, respectively of the excavations.

Passing of routes through fields with draining system will stop the functioning of draining veins. The water balance of soils on large territories will worsen seriously.

The implementation of alternative A, B or Green variant (Votan) will affect large areas of the Pirin Mountain, which until now have not suffered from anthropogenic impacts. Almost all of the route for these variants will cross the mountain with tunnels and bridges, but the temporary construction of roads and facilities serving the building of tunnels, bridges and building structures for these will affect considerably the mountain landscapes, including soils. Disposal of huge volumes of earth and rock materials is expected and this will again have strong negative impact on the landscape balance. Big volumes of soil will be irreversibly destroyed. Felling of forests, combined with breaking of the integrity of the soil profile will provoke powerful development of water erosion, which is already one of the very serious local ecological problems. The flow of solids on surface waters will increase significantly, especially from earth material depots.

#### **During operation**

Contamination of soils with heavy metals is assessed as one of the major ecological problems related to the implementation of transport projects. Despite of the prognosticated motor traffic, the intensity of aerosol contamination is expected to be lower than that of the currently existing road. It is possible to say that the prognosis for ecological alterations to the soils as a result of the variants of Spea and Krasi Bo will be insignificant and will affect only limited perimeters.

The recommendation is to apply appropriate forestation on the stripes alongside the road, to reduce the level of contamination of cultivated agricultural plants. The excavation volumes of soils with lighter mechanical composition that cover slopes shall also be optimized, in view of the water erosion restriction. The banks of excavations/embankments must be properly terraced, reinforced and planted with grass/trees, as to limit the water erosion development. The lands from the sides of the highway (stripes with width up to 100 m) that are potentially threatened with contamination must not be used as meadows, pastures, green crops, foliar vegetables and tobacco.

### **4.7. VEGETATIVE AND ANIMAL WORLD**

#### **4.7.1. FLORA. PROTECTED NATURAL TERRITORIES**

##### **Section M2**

During the building of Section Dolna Dikanya - Doupnitsa there will be minimum anthropogenic impact on the partially preserved phytoformations and historically formed artificial ecosystems (meadows, bushes, forests, fields, orchards). From point of view of protection of the animal world the Red, Blue and Brown variants are almost equal in value, with slight prevalence of the Brown. The orange alternative and part of the green variant pass through tunnels, above which the terrain can be expected to become drier and the condition of the coniferous cultures with anti-erosive effect could significantly worsen.

### Section M3

A combination between Brown and Yellow variants is recommended for Section M3. The brown variant with branches I, II, III passes through terrains almost identical with the Green variant, but affects more the lands located in the wet areas near the river of Strouma, some of which are important ornithological locations or have conservation importance.

The green variant runs almost entirely through artificial ecosystems strongly affected by human activity - coniferous plants and agricultural lands: arable land, meadows, orchards, vineyards, etc. - most of its length covers the route of the old road. From the point of view of preservation of vegetation formation this variant is preferable. Its disadvantage is the fact that it is designed at the expense of First-class Road I-1.

### Section M4

From Blagoevgrad to Simitli, the designed routes (Brown, Green, Red variants) run through vegetative formations affected significantly by the human beings - arable lands, meadows, orchards, coniferous forests, etc. These variants cross NPA "Oranovski Prolom - Leshko" BG 0001032, NPA «Kresna» BG 0002003, NPA "Kresna-Iilindentsi" BG 01000366 and the reserve «Tisata».

In the beginning of the Section - at NPA "Oranovski Prolom - Leshko" - to Kroupnik the Green variant is identical with the Brown variant, they both plan for tunnels and can be supported as they use the existing first-class road and do not make considerable advance to new territories.

The alternative routes designed only for the area of the Kresna gorge pass through intersected terrains, some of them with steep slopes and big difference in levels, by crossing partially preserved and strongly modified under the anthropogenic pressure vegetative formations. At some spots the routes go through previously cultivated land now covered with orchards or secondarily formed bushes. From the point of view of preservation of protected territories these alternatives are not acceptable, even if the routes here could be preferred with certain remarks - they are located entirely outside the territory of the reserve Tisata and Corine area. However, the configuration of the terrain through which the alternatives will run requires large-scale excavation and embankment works, with which many vegetation locations will be changed and thus the diversity of vegetative species will be changed too.

In this section all other proposed variants pass through protected territories, including the buffer zone of the natural reserve Tisata. They plan for considerable invasion and construction work in the adjacent natural environment. Therefore, for this section of motorway "Strouma" no new construction works are desired from the point of view of their potential harmful effect on the flora. The only possible solution could be through extension of the existing road.

The additional alternatives for routes in the region of the Kresna gorge presented in June 2007 (project design of NSI-2000) offer options for preservation of the flora in these locations, without any ecological compromises, because of the tunnels that are part of the design. These are the recommended preferred variants (Blue variant) for further development at the next stage of project development.

### **Section M5**

The character of the vegetation formations located in the territories attached to M5 of Motorway Strouma and the proposed variants of road routes give us a basis for making the following conclusions about the expected negative impact of the construction and operation of the highway on the flora:

- From the point of view of strong impact on the environment, in particular on the specific vegetation groups found on the territory of the protected area Moravska, the design variants Brown Dotted lines I and II are unacceptable and could lead to destruction of valuable biotopes;
- The designed Red variant crosses the village of Pripechene and NPA "Ograjden-Maleshevo" BG 0000229, NPA "Roupite" BG 0002098, and later NPA "Roupite-Stroumeshnitsa" BG 0001023. Near km.435+500 it turns left and merges with the Red alternative at km.436 + 500. It also hides the danger of serious violations in the wet areas near the river of Strouma, and with this variant the construction and operation of MW Strouma will seriously damage the partially preserved damp areas;
- South of the town of Sandanski the variants Brown Dotted line I,II,III are unacceptable, because they pass through the damp areas near Strouma, where vegetation groups typical for this biotope are partially or completely preserved and will be damaged by the highway construction and operation;
- About the Green alternative and the Green Dotted line described with it - this route is not preferred because of the anticipated large-scale excavation works. With this type of work some of the preserved natural habitats will be undoubtedly affected.

From the point of view of preservation of natural ecosystems with certain compromise in Section M5 can be accepted as appropriate the variants of routes presented as Red and Brown.

### **4.7.2. FAUNA**

An additional assessment of the expected influence of Motorway Strouma on the fauna is presented in Part Fauna in SEIA. Attached is also an assessment of the expected effect of Motorway Strouma, prepared by Association for Wild Nature Balkani. With the additional assessment, the expert on Part Fauna gave his answers to questions and remarks of MEW regarding the scope and completeness of item

4.7.2. "Fauna" in the EIA report from the month of February 2007. The expert's opinion is reflected in the choice of preferred variants by individual sections. The recommendations on this part are also included.

### **Section M2**

As a result from the construction works and operation of Motorway Strouma within Section M2, some adverse effects on zoocenoses can be expected, such as partially damaged or worsened nests of trees and bushes growing near the road, as well as habitats of some rodents. In the generative period the noise impact could play the role of a factor impeding the population of birds and mammals. The traffic will increase the danger of killing reptiles, amphibians and other slowly moving lower and higher animals. The road runways could store waste that could worsen the qualities of habitats of lower and higher animals and birds.

In the vicinity of the site considered in **SECTION M2** there are no protected territories and sites that could be affected by the construction and operation of the road route.

Regardless of the above, it is possible to make the conclusion that the construction and operation of this Section of the site in the considered (Blue, Red and Brown) variants will not lead to significant negative impacts on the fauna.

### **Section M3**

In Section M3 there are no natural ecosystems and biotopes - object of protection. Consequently, the highway "Strouma" in this section will not affect adversely the invertebrate fauna and insect groups. No serious negative effects on migrating birds can be expected too. The lack of large damp areas does not allow nesting birds to form colonies, i.e. no significant adverse impacts are expected.

The location of the route also in the presented variants does not hide hazards for irreversible negative effects on the diversity of species and the density of the fish populations typical for the river Strouma.

In relation to the animal world, we reckon the Green variant more appropriate for SECTION M3, as it develops on or in immediate proximity to the existing road E-79.

Near the respective site in SECTION M3 there are no protected territories and objects of the animal world, which could be affected by the construction and operation of the road route considered here.

### **SECTION M4**

SECTION M4 is the most problematic for the this site. Section M4 can be divided into 2 parts from North to South: **Part I - Blagoevgrad - north border of the Kresna gorge; and Part II - Kresna gorge** (to the South - a bit over the town of Kresna, to the North - next to the town of Kresna).

The gorge Oranovski falls within the scope of NPA "Oranovski gorge - Leshko" BG0001022. Here we should point the Green variant as

more acceptable, despite of the inevitable higher expenses for its building.

Most problematic is the southern subsection of Section M4, as it was designed to pass entirely through NPA "Kresna-Ilindentsi" and NPA "Kresna", i.e. through the very Kresna gorge. The following variants run through the gorge: Blue, Red, Brown and Green. Here the Blue variant plays the role of a zero solution, which in fact rejects the construction of a highway, i.e. preserves the currently existing first-class road.

The Red and the Brown variants go mainly through the lower parts of the terrain and few times cross the river. What is unacceptable for them is the fact that their implementation suggests destruction of the rock massifs on their routes in the lower parts of the terrain, which will inevitably affect the higher parts of the ravine.

In such cases the damaging of the middle zones of territories, respectively of sites with unique character is unwanted, as in the case of the Kresna gorge. Here, due to the deep faults of the terrain from both sides of the river, despite of the efforts put by designers, it is not possible to avoid laying some of the road route sections through. In this case the expression (impact) of the disturbance to some parts of a territory goes in the direction: soil - earth surface - vegetation - animals, due to the mutual relations between these main components of the territory. The infraction of the integrity of the earth surface leads to damages on the vegetation growing on it and of the shelters convenient for different animal species. Replacement of vegetation and shelters off the earth surface leads to the elimination of as many animals from one species, respectively of reproducing pairs or colonies, as many single habitats of theirs will be completely destroyed.

The green variant is designed to the west of the river, without crossing it. This variant is designed to pass mostly through tunnels and bridges between them. With this option the earth surface will be affected only in the spots of tunnels exits in both their ends and in the building of bridging facilities. This makes the Green variant rather safe for the middle part of the gorge, in comparison to the Red and Brown variants, mostly in the lower part of its western slopes. Here we should point out that with tunnels sometimes it is possible to have drying of the terrain, of different degree, immediately above the tunnels. Hence the delicate circumstance that the Green variant crosses the western (the bigger) part of the natural reserve Tisata not along the terrain, but in a tunnel, i.e. under the earth surface.

From the fours considered variants, most safe for the middle part of the gorge, inclusive of animal and vegetation populations, is estimated to be the Blue variant, i.e. the zero alternative (with the prerequisite of minimum construction works on it).

Apart from the variants which routes are design to run through the very gorge, another four alternatives are proposed: A, B and two Green variants. As a whole, they exclude the possibility for adverse effects on the environment in the core part of the gorge. Besides,

one of them, if constructed, will ease the transport situation inside the gorge, which is clear even to those who are not experts in road infrastructure, i.e. the existing road will continue to exist to be used locally. In reality, however, these variants do not even cross the territory of the buffer area, but nevertheless they also contain dangers for the natural reserve Tisata. What is more, these variants run through the eastern parts of the territories of the two NPAs - NPA "Kresna" and NPA "Kresna-Ilindnetsi", which is also an unwanted situation.

The addition to the Assessment of the environmental impacts in Section M4, preceded by public discussions and a number of discussions organized by FRRI, reflects also the opinion of the team who drafted the EIA regarding the Assessment of Impacts of Variants for Construction of MW Strouma on Protected Habitats and Species, prepared by the correspondents of the protected area for preservation of habitats "Kresna-"Илинденци", coordinated with the Association for Wild Nature Balkani, in which they presented a short structured assessment of the effects of different variants for construction of motor highway Strouma on a protected site, according to Directive 92/43/EEC".

Following the public discussions, statements by MEW and NGOs regarding the non-acceptance of the proposed in the Report of February 2007 "zero alternative" and the consequently developed Blue and Violet variants, a new assessment of the ecologically most appropriate technical solution in the area of the Kresna gorge was carried out.

The new variants appeared to be times better, as far as the fauna is concerned. Based on the analysis that includes also other components of the environment, a new preference is given in SEIA - preference for the BLUE variant by company "HCI-2000", which within the scope of the gorge presents a further development of the Green variant of Spea and involves a technical solution with long tunnels. The disadvantages of the tunnel solution were pointed out above. This change in the (reconsidered) recommendation for selection of a variant in Section M4 is reflected in the final recommendations for decision addressed in SEIA to the "Competent authority".

## Section M5

The variants developed are Green, Red, Brown. They pass through the lower parts of the terrain too, and only the Green one goes up the terrain in the area of the village Dolna Gradeshnitsa, east of the village. Here the Green variant runs along the left (eastern) bank of the river and next to the river, while the other two variants cross the river at few points, therefore involve the building of the respective number of bridging facilities. At the river of Kresna the two parts (vectors) of the Brown variant are designed to circle the town from both sides (from east and west). Further down - after the town of Sandanski, the Brown variant, and later (after the village Novo Delchevo) the Red variant separate and the lanes of the two directions of the highway run far from each other, then they join again under the village of Marikostinovo.

Here the variants go close to or cross some of the areas proposed to receive the status of protected areas: NPA "Kresna-Illindentsi" BG0000366, NPA "Kresna" (together with the protected area "Moravska" and the natural reserve "Tisata") BG0002003, NPA "Ograjden-Maleshevo" BG0000224, NPA "Roupite-Stroumeshnitsa" BG0001023. The biggest point of crossing falls within the scope of the northern parts of NPA "Kresna-Illindentsi" and NPA "Kresna", where it is not possible to avoid it. The other four cases (according to the documentation - with the Brown and Green variants) affect (cross) only some curves in the peripheries of the western boundaries of the same two national protected areas. These overlapping could be described as insignificant, and the problem here can be solved using two options: 1) if such a possibility exists, the route of the highway shall be replaced and taken out of the territories of these NPAs; and 2) these insignificant in size terrains shall be excluded from the territories of the two NPAs. If possible, the proposal from item 1) is to be preferred.

With the so described situation in this section of the site, it is logical to make the conclusion that the construction and operation of this section will not cause considerable negative impact on the fauna, i.e. will not cause full elimination or serious damages leading to very different change of the habitats or the extinction of rare or endangered animal species in this part of the country.

#### **4.8. LANDSCAPE**

The impact on landscape resulting from the future construction and operation of the highway is related respectively to surface rearrangements of the terrain and spreading of pollutants. The alterations expected from the implementation of the site could be minimized. No other preferences exist for the choice of a variant, different from those listed in items 4.5 and 4.6. The analysis showed that the construction and operation of Motorway Strouma will not cause significant changes to the inner structure and functioning of landscapes, which could bring to peculiar disturbances to the already established ecological equilibrium.

#### **4.9. HARMFUL PHYSICAL FACTORS**

The expected noise specifications of the transport traffic for the years 2010, 2015 и 2020 has been calculated for different sections of the future road (M2, M3, M4 and M5). The results obtained are quoted in tables. Also in tables are shown the values of the traffic intensity and structure. The width of the noise-protection area is determined (approximate distances in meters) for the prognostication period 2020, when the hygiene norm for noise in populated areas and the objects included in it will be reached. Variants for routes have been graded from the point of view of minimum noise effects in each Section. The comparison between variants from acoustic point of view gives priority to the Brown variant.



During the road construction the noise regime in the district of the respective Section worsens, but the negative impact lasts over a limited period of time and only during the day.

#### 4.10. HEALTH AND HYGIENE ASPECTS OF THE ENVIRONMENT

EIA systematizes the main risk factors with adverse impact on the health of the people working on the implementation of the investment proposal Motorway Strouma. Practical requirements for reduction of risk and safe labor conditions are stated.

Defined harmful effects due to the execution of construction works:

- combustion gases from ICEs of machines;
- dust from road construction;
- noise from transport means;
- asphalt vapors during road building.

Recommendations are made for health monitoring of the population residing the settlements located near the route of the future highway, in accordance with the generally accepted directions for assessment of the health status of the population, and these are coordinated with the existence of a road route in the vicinity.

During the road construction, the parameters of the acoustic medium will be temporary aggravated during the day in the nearest to the route settlements, as indicated in the respective part of the prognosis.

There are three settlements, which will be in the immediate vicinity of the highway with any of the variants: residential quarter Levski, town of Kocherinovo, the town of Kresna and the village of Strouma. It is possible to say that hygiene and protection measures need to be taken in respect of the population of these three settlements during the time of construction of the highway.

Near the different variants for route of the future motor highway Strouma there are residential territories of some of the settlements (areas with standard rates of noise).

From acoustic point of view (minimum noise impact), the grading of variants for the route of motor highway Strouma for the separate sections is as follows:

**Section M2** - BROWN, BLUE, RED;

**Section M3** - BROWN, YELLOW, GREEN;

**Section M4** - the open variants are equal in value; preference is given to the tunnel variants of "SI-2000";

**Section M5** - BROWN, GREEN, RED.

The comparison of variants for M5 gives priority to the Brown variant.

EIA lists the major requirements for safe labor. The hygiene analysis shows that the building of highway "Strouma", if carried out in compliance with the requirements for such type of facilities and provided that the necessary protection measures are taken, shall not lead to significant change in the health status of the

population and the hazard to the health can be prognosticated as low.

The new and better technical parameters of the highway route, compared to the currently existing first-class road, will contribute for the more efficient work of the internal combustion engines, which will practically prevent the increase of noise, dust and toxic chemical emissions. This will affect positively the sanitary-hygiene environmental conditions and in particular the living environment of the population residing in the settlements through which the current first-class road passes.

It is possible to reach to the conclusion that provided all above mentioned recommendations are observed, the investment proposal Motorway Strouma can be implemented without causing hazards for the health condition of the road construction workers and the population of the nearby settlements.

In relation to the additionally developed by NSI-2000 two new variants - Blue and Violet, for the area of the Kresna gorge, involving the construction of long tunnels under the Maleshevska mountain and taking the auto traffic out of the gorge, an addition was made to item 4.10 to point out the hazards for human life and health in the case of occurrence of failures inside the tunnels. Examples from the world practice are quoted. In this line, some recommendations have been made for the stage of tunnels design and operation.

#### **4.11. MATERIAL AND CULTURAL HERITAGE**

Judging by presented graphic materials, the road designed in a number of variants, avoids crossing places where cultural or historical monuments are known to exist.

However, taking into account the fact that the territory crossed by the highway contains a large number of such monuments and sites, it is possible to suppose that in the same territory there are areas with high archeological potential that cannot be foreseen in advance.

From the point of view of preservation of cultural and historical monuments, all designed variants of motorway Strouma can be assessed as acceptable. They are not expected to cause non-allowed demolitions of cultural or historical sites.

#### **5. RECOMMENDATIONS FOR CHOICE OF PROJECT DESIGN**

The main criteria for choice of a route for Motorway Strouma are the following:

- Provision of a first-class road alternative to the highway.
- No need to violate or replace the routes of the existing communications - railways, gas pipeline.
- Bypassing settlements.
- No air pollution exceeding the standard norms or worsened acoustic conditions allowed.

- No violation of water supply areas and no destruction of water sources allowed (including of mineral water). No corrections to the River of Strouma allowed.
- Avoidance (minimum entrance into) of protected natural territories (including those planned to become part of Natura 2000”).
- Avoidance (or minimum entrance into) of areas with natural resources (deposits), which can be explored in future.
- Options for bonding with the existing and prospect transport infrastructure.

The assessment of individual variants by environmental components is not identical. In relation to the above criteria, we request a combination of the following variant solutions for the next stage of design and construction:

- **Section M2 - Dolna Dikanya - Doupnitsa: BROWN variant;**
- **SECTION M3 Doupnitsa - Blagoevgrad:** Combination between **BROWN-YELLOW** (with recommendation to link at km 356+000 - 358+000 and to make improvements at the next design stage);

- **SECTION M4 Blagoevgrad - Kresna**  
**Subsection Blagoevgrad - Kroupnik:** Combination between **GREEN and RED** (with recommendation to link at km 372+830 and to make improvements at the next design stage);

**Subsection Kroupnik - Kresna: Zero alternative** (possible Blue variant, without extension of the road clearance and without road building works that could drastically affect the nature); **Green** - for additional investigation and design.

**For the same subsection, following public discussions and the consideration of two additional alternative project design solutions - Blue and Violet tunnel variants (June 2007), the above made recommendation is changed and in the supplement to the SEIA THE BLUE VARIANT DEVELOPED BY NSI-2000 IS SUPPORTED.**

- **Section M5 Kresna - Koulata:** Combination between **BROWN-GREEN-BROWN** (with recommendations for improvements at the next design stage);

The routes of recommended variants are shown on the situational map attached to the report on EIA.

## 6. FAILURES

This part of the report on EIA contains analysis of the causes and the risk of occurrence of failures/emergency situations, the measures for emergency prevention, as well as the main stands in the future emergency action plan. The technical parameters of the designed highway road establish conditions for reduction of the number of objective reasons for occurrence of emergency situations.

**The recommendation of the Blue variant by NSI - 2000 as proposed in June 2007 necessitates special and very strict requirements to the design, building and operation of the road tunnels of long distance in the area of the Kresna gorge. Allowance of emergency situation in the section with tunnels could cause**

extremely severe consequences for the life and health of transported people. The alert system, the blocking of sectors of the tunnels and the evacuation of passengers must correspond to the global experience and should plan for technological solutions that do not allow the occurrence of such situations.

## 7. OWN MONITORING

The monitoring program should be developed following the selection (and respective technical development) of the project variant (respectively a combination of variants) that is the best possible from technical and economic point of view and the most appropriate for the purpose from nature point of view. In all cases, this program should provide specific measures for continuous supervision of environmental changes resulting from the construction and operation of the highway - for each component of the environment individually:

- Air - check of air parameters (especially when the highway starts to function) above the road lanes and in the end quarters of adjacent settlements; inspection of air parameters in the tunnels.
- Water - regular inspection of the parameters (contamination and flow) of surface, underground and mineral waters, as well as the condition of the draining facilities: culverts, ditches (in order to prevent blocking or swamping), etc. Monitoring for possible drying near tunnels. The river of Strouma is included on the national monitoring network for surface water courses, which can be combined with the highway monitoring.
- Waste - the regular inspection of the condition of shoulders of the road, ditches, places for rest, gas stations, auto service shops and right of way ranges in relation to the expected pollution with domestic waste.
- Geological medium - permanent observation and control of deformation processes development, activation of landslides and collapses, erosion, etc., especially in the area of the Kresna gorge and the natural amenities, such as the earthen pyramids near the highway.
- Active continuous control for protection of the flora and fauna, especially in the areas of (and near the) protected natural sites. Special stress on the Kresna gorge and the reserves Tisata and Moravska. The implementation of plans for planting greenery near the highway should also be followed with attention.
- Control of soils and landscape in the territories surrounding the highway (arable land - fields, orchards), to prevent pollution with combustion gases and spillouts in cases of emergencies/failures.

- Permanent evaluation of the noise levels in adjacent settlements, to allow taking of constructive measures (building of screens, etc.) for limitation of excessive noise.
- Inspection of the health status of the population in the closest settlements and road food facilities, to allow adequate measures in case of increased rates of sickness due to the construction and operation of the highway.
- Effective observation and control of the construction works carried out on the highway, aimed to protect the affected material and cultural objects.
- Special supervision of the construction works and the operation of all tunnels, especially of the long tunnels in the area of Kresna.

In this case the monitoring shall be supported with various solutions and measures, if alterations to the normal state or physical destruction, degradation or collapses occur, as well as unallowable succession processes near the highway, unacceptable from health point of view living conditions, etc.

The special status of the Kresna gorge, if affected by the construction work, requires planning of adequate and strict monitoring.

**8. CONCLUSION**

With this analysis and assessment of the presented project design variants, condition of components of the environment and prognosis for the development of the road traffic in the region, it is possible to make the conclusion that Motorway Strouma is necessary and its construction and operation in line with the stated recommendations are ecologically acceptable.

The team of EIA recommends to the Competent Authority to take a positive decision regarding the building of Motorway Strouma, according to the proposal of item 5.

August, 2007 г.

Head of Team:.....  
(Asst.Prof.Dr.Eng. D.Denev)