ENVIRONMENTAL IMPACT ASSESSMENT
SECTION KLADANJ-PAKLENIK

-DRAFT-

ELABORATED BY THE

HYDRO-ENGINEERING INSTITUTE SARAJEVO

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1 PREAMBLE

The road alignment M 18 Šićki Brod – Semizovac presents one of the very important road directions in the country and wider region. It was built 45 years ago. Larger part of the section is characterized by very simple technical elements, steep horizontal and vertical curves, bigger longitudinal slopes, as well as inadequate width of surface of the road in the curves of smaller radiuses and inadequate drainage design. On the existing road, at gradients, the exploitation speeds are low and range from 35 – 45 km/h, which is especially pronounced in case of heavy vehicles, and that causes the accumulation of vehicles, reduces the level of the service and affects the safety of vehicle movement in the traffic. Due to that, the longer lines of vehicles are created and the exploitation costs are increased as well as the driving time.

The costs of the maintenance of the section Kladanj-Paklenik, which is section including the saddle «Karaula» at elevation approx. 1,000 meters above sea level, in winter period are high and conditions for driving are more difficult and complex, with large presence of frost and snow.

Besides these technical lacks, the existing alignment presents the concept which is in the contrary with the modern solutions and requests which the road of this class should meet in the location sense as well. The road passes through a number of settlements, and it is connected with the large number of individual connections due to which the vehicle speed of movement is reduced and automatically the road is not any more in function and significance it has been planned for.

With the aim of the mentioned situation, during 1987 the project documentation has been done under the title «Project Feasibility Study – construction part» by the Design Engineering Company PZ «Traser». After that, «Study of traffic economy justification for the improvement of traffic conditions at M 18 Tuzla – Sarajevo» has been done by the Institute of Traffic Faculty in Belgrade in February 1989.

On the basis of the indicators of this Study, the Paklenik-Olovo Section has been evaluated as the priority one. Thy Conceptual design has been done by the Design Engineering Company «Divel», Ltd. Sarajevo with more variants which have been studied and done in details, and the most favourable variant has been adopted and it has been confirmed in written by the revision commission with the proceedings No: 01-02-165-3/05. On the basis of the adopted variant, the designer engineering company has been prepared the Main Design of the concerned section.

The designed alignment of the road Kladanj - Paklenik, is in the line with the existing route of the main road Sarajevo-Tuzla in one part of the road, while in other parts of the road the new alignment has been designed because of the improvement of the traffic conditions. From the beginning of the section in Kladanj, the alignment is located on the right bank of Ujića River to the profile P-37, where along the bridge over the local spring, it enters into the tunnel of the rocky massif Ježevac, which is 639.0 m long. From the exit portal, at the profile P-66 to profile P-76, the alignment is located in the slope terrain, and then it enters again into the tunnel which is 525.0 m long and exits immediately above the riverbed of Ujića River. From the exit portal, the alignment crosses the existing main road over the bridge and passes on the left bank of the river, where on the profile P-79 it enters again the tunnel, in the mild curve, which is 308.0 m long, 0 to profile P - 81. From the exit portal at the profile P-81, the road alignment is going along the existing main road Sarajevo-Tuzla to profile P-139, at the elevation point 4+540, with the insignificant corrections for the putting the existing sharp curves into the line. Due to the improvement of the traffic elements, the alignment is separated from the existing road from the point of profile P-139 and over the bridge goes along the nameless spring almost rectilinear and go to the profile P-173, where it enters the tunnel below the saddle Karaula, which is 850.0 meters long. From the exit portal, at the profile P-174, the alignment is located on the slope up to the profile P-238, where it approaches again to the main road all the way to the end of the section near the Paklenik.

With the aim of the prevention of the negative impact of the planned reconstruction of the road direction M 18 Šićki Brod – Semizovac, of the section Kladanj _Paklenik on the environment in the area where the alignment of the road passes through, it was necessary to collect the information on the state of the environment, as well as to prescribe the mitigation measures of the negative impacts what is the task of the EIS.

In relation to that, the expert team of the Hydro-Engineering Institute has reviewed all available documentation, carried out the inspection on the field, contacted different interested parties, and on the basis of the available indicators carried out the identification of the impacts, analyzed them comparing to the best available practice and recommended the environment protection measures which should be integrated in the environmental permit.

Public participation, i.e. participation of the interested parties is defined by the legal requirements, and it is of the essential importance for the identification of the potential conflicts of the road alignment with the natural resources, the existing infrastructure, as well as with the physical planning documentation. With respect to this, the project team insured the contacts, consultations, and the direct participation of the recognized interested parties, before the very official procedure of the public participation.

As the most significant interested parties in this moment of development of the project documentation, the following has been contacted:

- Ministry of Physical Planning and Environment Protection of Tuzla Canton,
- PC Institute for Protection and Use of Cultural, Historical and Natural Heritage of Tuzla,
- Public Company of Forest Commercial Organization of Zenica-Doboj Canton, Commercial Unit of Forestry Olovo,
- Public Communal Company Bioštica Olovo,
- Cantonal Institute for Urbanism and Physical Planning of Zenica,
- Association of citizens of Hunting "Sokolina" Kladanj
- Sport Fishing Association "Drinjača" Kladanj,
- Municipality of Kladanj,
- Municipality of Olovo,
- Fishing Association of Orlja, Olovo,
- Hunting Association of "Tetrijeb", Olovo
- Public Communal Company "Komunalac", Kladanj,

All received comments, which are given in Annex 2, as well as findings and conclusions from the held meetings have been fully taken into consideration in identification of negative impacts of planned road alignment, as well as in definition of measures for prevention, i.e. for mitigation of those impacts.

As the result of the activities on the preparation and construction of the planned road, the following possible environmental impacts have been identified, analyzed and valued, as well as the prevention/mitigation measures and also the responsibility for their implementation, which are given below in tables.

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Impact	Impact significance	Prevention measures	Responsibilities
On waters **During construction:** ▪ Construction works (mining, deep excavations, demolition and removal of the natural cover layer and other). In that way, the disturbances of natural resources of fertilization are possible, and in the same time by removal of the covering layer and by creation of new drainage areas, the muddy water or in some other way polluted water drain fast into the ground. ▪ The construction machines – the potential danger from the spilling or accidental outpouring of oil and oil derivates, disposal of motor oil or similar waste. ▪ Uncontrolled disposal of excavated material that is covering up the riverbed of the watercourse with the excavated material and other construction material. Special danger in covering up the riverbed presents the problem of reduction of its discharge capability what can have negative consequences in passing the high floodwaters. ▪ Throwing away the different garbage from technological process of construction and construction complex sites onto the banks or directly into the riverbeds what leads to water pollution and spreading of the pollution along the watercourse. ▪ Disposal of different waste from the technological process of construction works complex sites on the banks of the river or directly into the riverbeds cause the pollution of water and spreading of the pollution along the watercourse. ▪ Use of inadequate materials for construction. ▪ Uncontrolled drainage of sanitary waters and polluted rainfall water. Due to the vicinity of the watercourse, the construction works of the concerned road can cause turbidity of the watercourse. Such occurrence is not permanent and after finalization of the construction works, such occurrences would be reduced, i.e. would disappear with time with the application of necessary measures for the restoration of the excavation, as well as for	The alignment of the planned road on the concerned section n Kladanj- Paklenik is not located within the defined water protection zones, so the negative impact on them is not expected. The alignment passes near and over the area of rich hydrograph, of which the Ujića River canyon presents the protected landscape**.** The impact on waters might be **significant**, so that it is necessary to strictly adhere to the listed measures of prevention and mitigation.	**I** **During construction** ▪ Preparation of Waste Management Plan and Plan of Measures in the case of accidents. ▪ Preparation of the Organizational Project for the construction site with the adequate solutions of drainage and treatment of sanitary wastewaters, as well as rainfall water from the yon of the construction site. ▪ Disposal should not be done in the riverbed or along the banks of the river. ▪ All excavated material, which will not be immediately used in the construction works must be disposed on the locations planned for that in accordance with the Organizational Project of the construction site (dumpsite of the surplus of the material) protected from the occurrence of the erosion, as well as outside of the vicinity of the watercourse. ▪ To the maximum extent, preserve the vegetation cover, i.e. leave the buffer zones formed from the vegetation cover between the roads and watercourse. ▪ Near the watercourse use only clean material for the embankment, such as pebble, without presence of earth or other impurities. ▪ Protect the areas near the banks which are sensitive to the erosion by means of stabilization and with plants which prevent the erosion. ▪ Prohibit any temporary or permanent disposal of waste material on the surrounding soil, except on the area	**During construction** Contractor.

Impact	Impact significance	Prevention measures	Responsibilities
the regular drainage.		planned by the Organizational Project of the construction site, and insure the water impermeable containers for waste. ▪ Supervise the processes of formation of deposits, and organize cleaning of the bottom and the cutting of the riverbed form the surplus of the material. ▪ Carry out frequent and controlled management of the municipality and dangerous waste in prescribed way. ▪ Establish the continuous supervision during the construction works with the presence of the specialist for the environment protection. ▪ Sanction by discipline measures the violators of the established code of conduct. ▪ Accept the used water from the construction site with the adequate sewerage systems, collect them in the water impermeable reservoirs and treat them in the prescribed way (either on-site of off-site), and before discharge into the recipient or city sewerage system. ▪ At the locations of the construction site, instalment of the eco toilets is mandatory for it is necessary to the workers. ▪ Ensure the areas with the water impermeable layer for the storage and servicing of the construction machines, outside of the defined sensitive zones. ▪ Collect the oiled rainfall water from the construction site in the water impermeable reservoirs and treat them in the prescribed way (either on-site or off-site), and before discharge into the recipient or the city sewerage system. ▪ All construction site areas and other impact	

Impact	Impact significance	Prevention measures	Responsibilities
		zones are necessary to restore during the construction in accordance with the Plan for restoration, i.e. depending on the future use of the area put in the original state. ▪ In the case of accidents, spilling of the fuel or lubricants into the environment, the urgent intervention is necessary in accordance with the Plan for urgent interventions in the case of accidents. **During exploitation**: ▪ In the zones near the watercourse, plan the closed system of surface drainage for the high speed road with the biological treatment instead of currently proposed system ▪ Protect the areas sensitive to erosion with the means of stabilization and plants which prevent the erosion. ▪ Prepare the Operational Plan for regular and special maintenance of the drainage system of the high speed road. This plan regulates the scope and time interval of the procedure of control, cleaning and if necessary repair of the structures for drainage system for rainfall water and structures for their treatment. ▪ Define by Plan the way of management of material created by the process of cleaning and maintenance of the drainage and treatment system in accordance with the Law on waste. Preparation of the Plan and its implementation is in the competence of the service for environment protection. ▪ Prepare the Operational Plan for the procedure of winter maintenance (use of salt and other agents for defrosting) taking	

Impact	Impact significance	Prevention measures	Responsibilities
During exploitation: Pollution of the rainfall water which falls down on the road due to: ▪ Losses from the system for driving and lubricating (petrol, oil, motor oils, liquids for cooling and breakage), ▪ Waste of tires and products of the wearing of the surface layer (pieces of the asphalt and bitumen), ▪ Emission of combustion products of driving fuel (lead and lead compounds, not fully combusted hydrocarbons, nitrogen oxides, soot and tar). Accidental pollution caused by the traffic accidents. Accidental situations cause spilling and spreading of the harmful and dangerous material, the most often accidents are the one where spreading of the oil derivates occur which have the large capability of diffusion into the terrain and the ground. Due to the complexity of flowing and retaining of the water in the ground, the pollution with the oil derivates has the character of long-term action. Pollution can activate in different hydrological conditions.		care, in the first time, of water and soil protection, and then also of global problem of environment protection. The Plan should include: -definition of adequate locations and way of storage of chemicals which are used for maintenance of the high speed road, use of the chemicals should be reduced into minimum with the correct prognosis of the surface of the road state.	**During exploitation** Institution competent for the management of the high speed road (FRD)
On air quality **During construction:** ▪ Use of the construction works machines cause more significant emissions of pollutant into the air (CO, SO_2, soot), as well as "creation" of dust during work and movement of machines and vehicles. ▪ Use of mining for excavation in the rocky material – especially in open area (in the alignment, in quarries – borrow pits), and in tunnels in small extent cause the occurrence of emission of pollutants – explosive products (CO_2, oxides, acids) and large quantities of stone dust. **During exploitation**: ▪ Air pollution caused by the components which are products of combustion due to motor operation. The largest impact of traffic is concentration of nitrogen oxides. ▪ Concentration of pollutants along the alignment is condition of mainly size of the emission (density of the traffic, type of	The alignment mainly passes through unsettled area so that the impact during construction is minimal, and **potential impact is possible only in the settlement of Kladanj.** **During exploitation**	**During construction** ▪ Install the filters for soot removal on exhaust pipes of all machines and vehicles with diesel engine. ▪ Ensure maximum accuracy and functionality of combustion system for driving fuel by regular (periodically planned) and special technical inspection of the vehicles and machines, use (and regularly control) the fuel – with guaranteed quality standard. ▪ Prevent dust, which is created regularly at the temporary construction sites of the roads with the periodically sprinkling of surface of the road and work places. ▪ In the case of excavation by mining in the rocky massif, select the type of the explosive which has the minimal harmful	**During construction** Contractor

Impact	**Impact significance**	**Prevention measures**	**Responsibilities**
vehicle, driving regime, etc.), meteorological parameters (prevailing wind direction, climate conditions, existence of the vegetation along the road) and configuration of soil. Area where the largest negative impacts on air quality can be expected on the concerned section are the one that passes near the settlements, which are designed in the slopes or if they are located in the immediate vicinity of crossings or tunnel portals.	The positive fact is that the road passes through the terrains, which enables the natural air circulation, so that it has been evaluated that its use will have **minimal impact** on air quality along the alignment.	impacts for the environment.	
On soil and agricultural land **During construction** The roads have the multiple impacts on agricultural soil and agricultural ecosystems in their immediate vicinity and in wider area as well. The largest and irreversible damage done to the soil is the permanent change of the purpose of use of soils, because they are completely and forever excluded form the plant – agricultural and forestry production. The fact that the soil is limited natural resource of exceptional importance should be kept in mind. The second type of damage is splitting of the parcels-parcelization. The request for efficient traffic development is often in collision with the request that the parcels for production be as less as possible divided and in that way parcelized. During the construction works of the alignment, the occurrence of the erosion will also happen due to the removal of vegetation and cutting of the soil. Also, during construction, the use of construction machines can cause the contamination of the soil due to spilling of oil, lubricants and fuel, and what would reflect through the occurrence of the organic pollutants, the presence of different hydrocarbons, etc.	**The significant impact is not expected** on soil and agricultural land since the planned alignment passes mainly through the areas which are currently not used considering that those areas are under the mines.	**During construction** ▪ All manipulation with the petroleum and its derivates in the construction process, the supply of the machines, is necessary to carry out with the maximum measures of protection in order to prevent the spilling. All packaging material fir oil and other derivates of petroleum must be collected and dispose on the controlled landfills of the contractor from where it is taken away in controlled manner by the authorized waste municipality company. ▪ The parking of the machines must be done only on the regulated locations. At the locations of parking of the machines, take the special measures of protection form the pollution of the soil with the oil, petroleum and its derivates. If the soil pollution occurs by leaking of oil or in some other way, that layer of earth is necessary to remove and deposit on the landfill. ▪ It is prohibited to wash the machines and vehicles in the construction work zone. ▪ During performing of the earth works, the humus lays should be deposited, protected from the pollution, and later use for regulation of the embankment and green zone along the road.	**During construction** Contractor

Impact	Impact significance	Prevention measures	Responsibilities
During exploitation: During the exploitation of the high speed road, the contamination of the soil can occur due to the exhaust gases, tire wearing and road maintenance and what means the following: ▪ Organic pollutants, presence of the different hydrocarbons, ▪ Heavy metals, and especially lead, zinc and cadmium ▪ Presence of the salt, which is used in winter period due to the prevention of the occurrence of the frost.		▪ All areas damaged by the construction works put into the original state, or regulate in horticultural way after the finalization of the works. ▪ For all borrow pits, the special restoration projects must be prepared in order to prevent the degradation of the larger areas of soil. **During exploitation** ▪ Protection measures during the construction are the regular maintenance of the drainage system, wind protection zones and protection fence.	**During exploitation** Institution competent for the management of the high speed road (FRD)
On microclimate **During the construction:** The change of microclimate in the zone and during the construction works will not be especially present, except in the form of air heating and emission of air pollutants, what can cause the effect of "blurred" atmosphere and consequences in the form of higher air temperature in the narrow zone of the construction work site. **During exploitation:** The asphalt surface of the road is generally good recipient of sunrays, so that the temperature of the very surface and the	Generally, all effects relate to the narrow area around the very alignment. It is necessary to consider that this impact is already present, and during the reconstruction of the road the increased	There are no special measures for prevention/reduction of impact.	

Impact	Impact significance	Prevention measures	Responsibilities
temperature of the environment increase. That effects also the reduction of the relative air humidity value in the concerned area, as well as the evapotranspiration.	impact is not expected. The impact has been evaluated as **insignificant**.		
On flora and fauna **During construction** ▪ The plant and animal habitats will be disturbed due to the establishment of the construction site, work area and temporary dumpsites of the material. The entire process will largely contribute to the loss of primarily vegetation cover as the main habitat of the animal species. ▪ Heavy machines used during such works cause compacting of the soil (disturbance of the pedofauna), by which the water balance is disturbed in deeper layers what also limit the growth of the plant species. After the construction, the damaged habitats will be settled by the plant species with well developed root system which area characteristic for the vegetation of the stamped habitats. ▪ Animal's characteristic for such area under the noise impact will be driven away from their habitats. Impact of the exhausted gases (on the plant communities) will additionally have the negative impact on forest animals and reptiles, as well as the terrestrial insects. ▪ Due to the active presence of the anthropogenic factor, the animal species mainly leave their habitats and go deeper into the ecosystem. **During exploitation**: ▪ Impact of exhausted gases onto the plant communities ▪ Death of animals	**During construction** Considering that the route passes mainly through the forest land with the valuable high forests, as well as the area rich with the wild animals with two large protected rivers, and it also is located near and it crosses the Ujića River which is natural fertilizer, impact on flora and fauna is evaluated as **significant.** Considering the above-mentioned, the impact has been characterized as insignificant, but the prevention measures should be applied yet.	**During construction** A number of bridges and tunnels have been planned by the project in the area of the mentioned hunting reservation, what can be considered as favourable solution from the aspect of protection of flora and fauna. **During exploitation** In the case of the definition of the more significant number of collisions with the animals during the first year of exploitation of high speed road, the developer will ensure, for the phase of later use for the critical sections, with respect to the construction requirement, the construction of necessary number of passages for enabling the terrestrial animals to pass above/below the high speed road, the installation of the wire fence of minimum size of the openings, as well as suitable and visible for the birds barriers for prevention of their low flights .	**During exploitation** Institution competent for management of high speed road (FRD)

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Impact on landscape **During the construction** ▪ Considering the general observation of the area where the planned alignment passes through, as well as the planned elements, it has been evaluated that planned project does not have larger negative impact from the aspect of reduction of aesthetic values of the area. Namely, the applied technical elements of the alignment are mutually harmonized, so hat the entire view of the alignment is pleasing. ▪ Taking into consideration that the terrain on this section is very exposed from each side, it is necessary to take care on the aesthetic side of the project that is the formation of the lower layer, as well as the horticultural arrangement of the wider environment.	**During construction** It is insignificant, but it is still necessary to apply protection measures.	**During construction** ▪ In later phases of the project solution, prepare the project for the landscape arrangement. ▪ The disturbance of the natural ambient in large extent is not possible to avoid with the construction works in the alignment of the road. Because of that it is recommended that the construction works should be done with the large care, in order to use the land as less as possible. In the entire alignment during the construction works, it should be taken care to use the existing road network, with as less as possible construction of new roads for the needs of the construction site. ▪ Constructor should remove the fertile soil during the excavation and dispose it on the location which is planned for that purpose. Excavated and temporary deposited fertile soil should be used later in horticultural arrangement of the road alignment. ▪ After the finalization of the construction works, all area of the construction site and other zones of the temporary impact should be restored, i.e. depending on the future use of the area (agricultural land, natural vegetation) put it into the original state.	**During construction** Contractor
Impact on protected area of nature The planned alignment is located near the two protected landscapes, i.e. the area of Karaula, as well as the Canyon of Ujća River. Most of the alignment in Karaula area passes through tunnels, while technical solution for the construction to overpass the canyon was not known at the moment of preparation fo EIA study	The impact on Karaula is assessed as lees significant while impact on canyon might be significant.	The overpass design must take into account river sensitivity so it should not be funded at the river bad or bank**.**	Designer, FRD
Impact on cultural and historical heritage **During construction**:	**During construction**: Impact is evaluated	**During construction** ▪ If the archaeological findings or evidence	During construction Constructor

Impact	Impact significance	Prevention measures	Responsibilities
▪ According to the available data, there is no direct collision of the alignment with the protected cultural and historical heritage. However, taking into consideration that this is the area of rich cultural and historical heritage, as well as that the precise locations of this values were not explored until today, it can be stated that the danger exists for the cultural and historical heritage in the area of the project to be directly endangered by the construction of the section, so that in accordance with that, the contractor must strictly adhere to the proposed measures. **During exploitation**: ▪ Use of the road does not have the negative impacts on archaeological sites if implementation of measures of protection be applied during the construction works within the project. ▪ If the presentation of the certain locations or values of cultural and historical heritage happens during the construction of the road, which until today was not present, it can be said that the positive impact on heritage has been achieved.	as potential.	of the cultural and historical values are possibly excavated during the construction works, it is necessary to stop the works and inform the competent institution about that.	
Impact on increasing the noise level Considering that this is mainly the unsettled area, it can be easily concluded that the project will not have the significant impact on increasing the existing noise level. In any case, after the finalization of the road, it is necessary to carry out the measurement of noise on significant locations, as well as prepare the model for spreading of the noise. In the case of increased values, it is necessary to define measures for protection against the noise.	Insignificant, but it is necessary to apply the prevention measures.	▪ On parts of the construction site and also in the settlements, the works should be carried out only during the day. Only in the case when it is necessary, the works should be carried out in the evening or during the night. ▪ Protection measures during the exploitation, i.e. during the traffic development, are not necessary in this phase, however, the monitoring results will give the basis for the possible corrections during the exploitation.	
Impact on infrastructure **During construction** Considering that the alignment crosses over many locations or partially the existing road, the interruption of traffic can happen	**During construction** Significant, it is necessary to apply the measures for prevention/reduction	**During construction** ▪ In the places where the new designed alignment crosses or it is partially on the existing road, take care of the solution that the traffic can be developed during the	**During the construction** Contractor

Impact	Impact significance	Prevention measures	Responsibilities
during construction Near the alignment there is only one bigger settlement (Kladanj), so that there is no larger number of connections fir roads and city streets, and during the construction the significant negative impact can not occur on the interruption of existing capability of traffic movement in the area. The alignment is located near and crosses over the gas installations, where in case of not adhering to the measures of prevention, these infrastructures could be damaged.	of impact.	construction works. ▪ Displace the pipes through the preliminary works at the places of collision with the existing installations; i.e. select/protect/isolate the pipes by technical measures. ▪ At the places of the collision with the existing roads, it is necessary to carry out the necessary temporary protective constructions which will separate the roads from the construction works zone; apply all prescribed traffic signalization and if necessary insure the traffic police patrols.	
Impact on inhabitants and population (social impacts) **During construction** During construction works, the certain negative impacts can appear due to the difficult approach to the private parcels while constructing, as well as to the large number of the construction machines which will be in relatively short period of time on the limited – narrow area of the project. **During exploitation** The faster and safer connection of two cities, Sarajevo and Tuzla will be ensured by the construction of this road.	**During construction** Impact has been evaluated as insignificant, but t is necessary to apply the measures of prevention/mitigation.	**During construction** Limit movement of heavy construction machines during the construction of the road, in order to make the surface of the soil devastated by the works as less as possible, i.e. use the existing road network which after the finalization of the works should be restored.	During construction Contractor
On use and organization of the area **On the** basis of the expert opinion given by the Ministry of Physical Planning and Environment protection of Tuzla Canton, the concept idea of the alignment somewhat deviates from the alignment planned by the Physical Plan of the Canton, what is acceptable from the aspect of physical planning because only through the preparation of the more detailed documentation (conceptual design and main design), can precisely define the alignment of the road, which will be implemented into the Physical Plan of the Canton if the agreement has been achieved and after the final adoption of the alignment. However, the construction of bypass is planned	**The impact has been evaluated as significant.**	It is necessary to consider the possibility of construction of bypass of Kladanj.	**Developer/Federal Road Directorate, Municipality Kladanj**

Impact	Impact significance	Prevention measures	Responsibilities
around the urban area of Kladanj by the Physical Plan, while the proposed alignment mainly stretches along the existing main road. Here it is necessary to carry out the additional analysis and harmonize the interests also with the Municipality Kladanj, which has the obligation to precisely draw in the new alignment of the road into the Physical Plan of the Municipality which preparation is ongoing.			

Considering that this section of the road Sarajevo –Tuzla is currently of very poor technical characteristics, the section has been already proclaimed as priority for restoration, so that the adequate documentation for reconstruction has been started to prepare in 1987. So that the design engineering company «Divel», Ltd. Sarajevo has prepared the conceptual design with several variants which has been done in details, and the most favorable one has been adopted among them and which has been confirmed in written by the revision commission with the proceedings No: 01-02-165-3/05. On the basis of the adopted variant for the project, the designer has prepared the Main Design of the mentioned section.

Because of this, the consideration of alternatives to the planned road alignment Kladanj-Paklenik in the context of environmental impact has been brought down to the alternative with the implementation of the project, since the improvement of the technical characteristics of the existing road alignment can be hardly achieved and not leaving the existing road corridor. Namely, the width of the protective belt is 20 meters for the main road. Width of the protection zone has been calculated from the road belt on both sides of the road.

On the basis of the previously given argumentation, it can be said that the implementation of the project, that is the construction of the section of Kladanj-Paklenik on the planned alignment, would give the significant contribution to the improvement of the safety of traffic between Tuzla and Sarajevo. On the other hand, the alternative where the implementation of the project would not happen would result with further significantly difficult communication between these cities.

The largest difficult in preparation of the draft of EIS presented the inexistence of the data o large number of significant environmental aspects such as the current air quality along the alignment of the high speed road, precise locations of the structures of cultural and historical and natural heritage, and similar.

Also, the significant problem is the inexistence of the physical Plan of Municipality Kladanj and Olovo through which the road alignment passes by.

It is necessary to point out that the largest difficulty presents the fact that this is the project for which the Main Design has been already prepared, where the alternatives have not been given, except the alternative without the project, which is unacceptable from all points of view.

However, taking into consideration that the planned alignment is in the collision with the protected natural area of the Canyon of Ujća River, it is necessary to consider the alternative possibility of the laying down the alignment in this area.

On the basis of the analysis, it can be considered that the planned project is in the collision with the protected natural area, i.e. with the canyon of Ujća river, which is protected from the stretch where the restaurant Jelen is located to the location of Mimoza, so that in that case it is necessary to consider the possibility of displacement of the alignment in this area. Also, in accordance with the plans from the Physical Plan of Tuzla Canton, it is necessary to consider the possibility of the construction of bypass of Kladanj, i.e. displacement of the main traffic outside of the settlement.

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2 INTRODUCTION

With the aim of the prevention of the negative impact of the planned reconstruction of the road direction M 18 Šićki Brod – Semizovac, of the section Kladanj _Paklenik on the environment in the area where the alignment of the road passes through, it was necessary to collect the information on the state of the environment, as well as to prescribe the mitigation measures of the negative impacts what is the task of the EIS.

In relation to that, the expert team of the Hydro-Engineering Institute has reviewed all available documentation, carried out the inspection on the field, contacted different interested parties, and on the basis of the available indicators carried out the identification of the impacts, analyzed them comparing to the best available practice and recommended the environment protection measures which should be integrated in the environmental permit.

Public participation, i.e. participation of the interested parties is defined by the legal requirements, and it is of the essential importance for the identification of the potential conflicts of the road alignment with the natural resources, the existing infrastructure, as well as with the physical planning documentation. With respect to this, the project team insured the contacts, consultations, and the direct participation of the recognized interested parties, before the very official procedure of the public participation.

As the most significant interested parties in this moment of development of the project documentation, the following has been contacted:

- Ministry of Physical Planning and Environment Protection of Tuzla Canton,
- PC Institute for Protection and Use of Cultural, Historical and Natural Heritage of Tuzla,
- Public Company of Forest Commercial Organization of Zenica-Doboj Canton, Commercial Unit of Forestry Olovo,
- Public Communal Company Bioštica Olovo,
- Cantonal Institute for Urbanism and Physical Planning of Zenica,
- Association of citizens of Hunting "Sokolina" Kladanj
- Sport Fishing Association "Drinjača" Kladanj,
- Municipality of Kladanj,
- Municipality of Olovo,
- Fishing Association of Orlja, Olovo,
- Hunting Association of "Tetrijeb", Olovo
- Public Communal Company "Komunalac", Kladanj,

All received comments, which are given in Annex 2, as well as findings and conclusions from the held meetings have been fully taken into consideration in identification of negative impacts of planned road alignment, as well as in definition of measures for prevention, i.e. for mitigation of those impacts.

2.1 Cause for the preparation of the project

The road alignment M 18 Šički Brod – Semizovac presents one of the very significant road directions in the country and wider region. It has been built before 45 years. Larger part of the section is characterized by very simple technical elements, steep horizontal and vertical curves, bigger longitudinal slopes, as well as inadequate width of surface of the road in the curves of smaller radiuses and inadequate solution of drainage. At the existing road on slopes, the exploitation speeds are low and range from between 35 – 45 km/h, what is especially present in heavy vehicles what causes the accumulation of the vehicles, reduces the level of the service and effects the safety of vehicle movement in the traffic. Due to that, the longer lines of vehicles are created and the exploitation costs are increased as well as the driving time.

With the aim of improvement of characteristics of the main road M-18, in the direction of Šićki Brod – Semizovac, The Federal Road Directorate starts the set of activities on the reconstruction of the road and designing of new sections. One of the activities is preparation of project documentation and Feasibility Study, which will be divided into sections as follows:

- Šićki Brod-Đurđevik, approx. 17.40 km;
- Đurđevik-Stupari, approx. 11.90 km;
- Stupari-Brloški Potok, approx. 4.70 km;
- Brloški Potok-Vitalj, approx. 8.70 km;
- Vitalj-Kladanj, approx. 2.40 km;
- Kladanj-Paklenik, approx. 13.20 km;
- Paklenik–Olovo, approx. 8.45 km;
- Olovo-Donji Čevljanovići, 19.95 km;
- Donji Čevljanovići-Ljubina, 9.90 km;
- Ljubina-Jošanica, 11. 30 km

The subject of this Study is section Kladanj-Paklenik. The explanation follows for the preparation of the project documentation for the construction of this section.

The costs of the maintenance of the section Kladanj-Podpakelnik which includes saddle «Karaula» at the elevation point approx. 1,000 meters above sea level are too high in winter period and driving conditions are more difficult and complex, with the large occurrence of frost and snow.

Besides these technical deficiencies, the existing alignment presents the concept which is in the contrary with the modern solutions and requests which the road of this class should meet in the location sense as well. The road passes through a number of settlements, and it is connected with the large number of individual connections due to which the vehicle speed of movement is reduced and automatically the road is not any more in function and significance it has been planned for.

Aiming at improvement of the abovementioned state, the design documentation “Feasibility Study – Construction Part” was prepared in 1987 by the Design Organisation “Traser Design Institute”. Afterwards, the “Study of Cost-Efficiency of the Improvement of Traffic Conditions and Tuzla – Sarajevo M-18 Road” was prepared by the Traffic Faculty Institute in Belgrade, in 1989.

On the basis of the indicators of this Study, this section has been evaluated as the priority. Thy Conceptual design has been done by the Design Engineering Company «Divel», Ltd. Sarajevo with more variants which have been studied and done in details, and the most favourable variant has been adopted and it has been confirmed in written by the revision commission with the proceedings No: 01-02-165-3/05. On the basis of the adopted variant, the designer engineering company has been prepared the Main Design of the concerned section.

2.2 Legal basis for the Environmental Impact Assessment

Environmental Impact assessment (EIA) is a procedure of evaluation of acceptability of the structure, regarding the environment, as well as determination of necessary measures for environment protection, in order to reduce the negative impacts at the lowest possible level, and in the same time to achieve the high level of environment protection.

Law on Environment Protection (Official Gazette of FB&H 33/03), Article 53.-64 prescribes the procedure of the environment impact assessment. Additional explanation can be found in the Rulebook on plants and installations for which the environmental impact assessment is obligatory and the plants and installations which may be constructed and put into operation only if entitled the environmental permit (Official Gazette of FB&H, No. 19/04).

Article 3. and 4. of the “Rulebook on plants and installations for which the environmental impact assessment is obligatory and the plants and installations which may be constructed and put into operation only if entitled the environmental permit (Official Gazette of FB&H, No. 19/04)” defines the installations for which **the environmental impact assessment is obligatory.**

Article 5.and 6. of the Rulebook defines the installations for which the EIA is carried out on the basis of the review of the Federal Ministry.

The concerned section of the road fully passes the territory of F B&H, i.e. the area of the Zenica- Doboj Canton and Tuzla Canton, so that the adequate Cantonal rulebooks should be taken into consideration on installation which should have the environmental permit before the construction.

a) According to the Cantonal rulebooks, the following infrastructure are under the obligation to have the environmental permit (Article 2 paragraph e):

- Construction of the new cantonal and local roads, from 1-2 km of continuous length
- Widening of the existing road with two and less lanes, in order to have four and more lanes, where the new road or repeatedly marked and/or widened part of the road would below 10 km of continuous length.

b) According to the Federal Rulebook, the division has been done into three categories:

Installations for which the EIA is obligatory:

- Construction of highways,
- Construction of new road or alignment and/or the widening of the existing road with two or less lanes in order to have four or more lanes, where such new road or repeatedly marked and/or widened part of the road would be 10 km long or longer continuous length,

Installations for which the EIA is carried out on the basis of the evaluation of the Federal Ministry and those are new cantonal and regional roads, with more then 2 km of continuous length.

For these installations, the Federal Ministry will define, for each individual case, if it is necessary to carry out EIA.

If the evaluation shows that it is not necessary to carry out EIA, the Federal Ministry will issue the environmental permit on the basis of the delivered documentation.

The concerned project presents the reconstruction of the existing road with the elements of the construction of new one. Legally this could be related to the **Article 6-** Construction of the new: Cantonal or regional roads with the continuous length of 2 km and more, **e.g. Infrastructure for which the preliminary EIA is first subject of the decision by the competent authority** (Federal Ministry).

3 DESCRIPTION OF THE PROPOSED PROJECT

3.1 Description of the physical characteristics of the project

The beginning of the alignment is between two bridges in Kladanj. The radius of the horizontal curve is 250 m; the alignment is separating from the existing road and crosses over the new bridge on the right bank of Ujića River. From the profile P-7 to P-15, the new designed road goes along the existing road and riverbed, where it is necessary to demolish the building of the waste municipality company.

Because of the vicinity and possible unfavorable action of the Ujica River on the body of the road, the designer had to build the protection for the bottom of the embankment with the concrete gravitation wall, in the length of 160 m. In front of the wall, the designer has foreseen the preparation of the stone fill up to prevent the eroding of the foundation of the wall, according to the detail which is given in the cross-sections.

In the part where the new designed road goes along with the existing road, for the settlements from profile P-7 to P-15, the designer has prepared the solution of displacement of the local road with the connection to the main road.

In the continuation from the profile P-15 to P-37, the alignment passes by the existing houses using the mild slope above the Ujića River.

At the profile P-36, the passage is foreseen at the existing local road with size 5m x 3.5m which enables the individual existing structures to connect with the rest of the settlement.

Further in the continuation, the alignment goes along the bridge over the Bukovica River and enters the deep cutting.

The alignment continues along the very steep slope, in the favorable radiuses 250m and 300m, 450m and 900m, crosses over the canyon and exits at the existing main road at the profile P-81. At the point, from the profile P-36 to P-81, two bridges have been designed, as well as two galleries and three tunnels.

From the profile P-81 to P-115, new designed road goes along the existing road with the small correction of the existing elements of the alignment, and partially cuts the slope in the materials with good geological characteristics. The alignment is in the same direction of the slopes of radius 350m up to the bridge on Ujića River.

From the profile P-115 to P-139, the alignment is laid down more straight in radiuses 550m, 800m and 550m. From the view of elevation point, it has been located at the critical ascend which stretches up to the saddle Karaula. The slope of the elevation point in the ascend are 8% in length 691.041m and 7.5% in length 1941.801m. The bridge at Ujića River is located at the vertical curve of 5,000m radius. The slopes of the hill caused that in this stretch, three bridges and one tunnel has been designed.

From the profile P-139 to the saddle tunnel Karaula, at the profile P-173, the alignment is located in the ascend of 7.5% and developed along the steep slope and conditionally stable terrain.

The entrance of the saddle part of Karaula is located at the elevation point 877.079 meters above sea level, and exits from the tunnel is located at 889.454 meters above sea level. The length of saddle tunnel is L=860m. The saddle tunnel Karaula is located in the vertical curve with radius of 13,500meters, with which in that way the slope of the elevation point is reduced and the more favourable conditions have been created for the traffic development. The slope of the elevation point at the entrance of the tunnel is 4.5%, and at the exit of the tunnel the elevation point descends for 1.6%.

The alignment from the profile P-174 to the end of the section at profile P-308 descends, with the slope of the elevation point of 7% in the length 1863.8m, 3.89% in the length

613.756m, 7.51% in the length 1430.319m, 2.97% in the length 217.526m. The applied radiuses in the horizontal curves in this part of the alignment are: 500m, 650m, 500m, 500m, 300m, 350m and 385m. In this part, four bridges and two shorter tunnels have been designed.

The designed cross-section of the section of the road Kladanj-Paklenik according to the Main Design for the reconstruction of the road M 18 Šićki Brod-Semizovac, the section Kladanj-Paklenik vary and is 13.55 meters in the embankment, 20.75 meters in the cutting and 25.35 meters in the cut.

3.2 Environmental Impacts of the infrastructure

Impact of the roads on the environment can be divided into:

- Impact due to construction of the road, that is impacts related to the construction (for example supply of the construction place with the equipment, temporarily and final storage of the soil material, pollutant emission and noise emission during the construction works, …)
- Impact due to the existence of the road, land exploitation, road impact as obstacle in the space, visual impacts,…)
- Impacts due to the road functioning, those are impacts caused by traffic and maintenance of the road (gas and dust emissions, water discharged from the road and contains the pollutants, noise emission,..)

Possible impacts of the planned project on the environment and population mainly have the local character and mainly are present in distances of 0 to 60 meters from the axis of the road. Wider area of the impact from the mentioned one can be expected from the impacts on surface and groundwater, in case of accident.

The special problem presents the accidental pollution, either during construction or during exploitation, which can not be predicted with time or in space.
The construction of the planned project includes the use of the construction machines which will have impact on the increasing of the noise level, emission of the pollutants and dust. But, that possible negative impact is of temporary character.

Especially the sensitive locations are the structures on the alignment, such as viaducts, overpasses and bridges because in their zone the larger space is necessary for the movement of the construction machines.

The surplus of the humus is present at the construction site, which has been removed at the entire area of the cross-section of the road. Part of the humus can be used for the covering of the road embankment, while one part stays as the surplus. Besides, the construction site waste has also been produced at the construction site, as well as the sanitary waste from the construction site. Both types of the waste are necessary to dispose on the locations foreseen for that. During construction, the material for construction of the embankment of the road itself is needed, i.e. with the opening of the borrow pit or with the exploitation of the old ones.

During the construction, water pollution can be caused by the construction machines. That is especially related to the pollution caused by the oil, petroleum and other used, and for the environment harmful liquids. Also, at the locations of the worker accommodation base, smaller pollution is possible from the process of food preparation as well as from the sanitary places.

Among the infrastructure systems in space, road traffic is the commonest source of noise. Also, the roads are the biggest "consumers" of the space, so that each new road unfortunately means the change of the purpose of the areas over which it crosses.

During exploitation and accidents, the impact on water can be direct and indirect. The direct impact can be expected with the pollution of water and soil by heavy metals and other pollutants from the exhaust gases. The abovementioned heavy metals and other pollutants carried by the wind will deposit in the surroundings of the road. Moved by the precipitation, they can reach the surface water and groundwater and pollute them. Also, the danger for the groundwater and surface water is possible from the consequences of traffic such as: leaks of the fuel and lubricants from the vehicles, wearing of the upper layer of the road, wearing of vehicle tires, use of chemicals for lubrication of the road pavement in the winter period. Such form of the pollution is continuous in time, i.e. it has long-term effects with the possibility of accumulation of pollutants.

Also, the surrounding agricultural land will be exposed to the emission of the pollutants and particles of the traffic flow, and the largest danger is related to the accidental situations during transportation of dangerous substances. That can cause the immediate contamination of surface agricultural layer and its permanent loss.

The motor vehicle traffic has a large share in air pollution caused by the fuel combustion process during the operation of the engine. The level of pollution depends on the number of vehicles, their technological development level, and quality of fuel. When considering the air pollution caused by the motor vehicles, two phases can be distinguished: phase of construction and phase of exploitation. During phase of construction, the periodically local occurrence of larger concentrations of gaseous combustion products of petrol and diesel fuels is possible (CO_2, CO, NO_x, SO_2, soot) used for the driving of the construction machines. The temporary local occurrence of the excessive concentrations of the same pollutants is possible in the direct vicinity of the largest load – points of longer stopping of the vehicles, during exploitation of the road at crossings and ends of tunnels. Typical values of the emissions of certain pollutants contained in the exhaust gases of the vehicles (petrol and diesel) are listed in the next table.

Table 1 Typical values of the certain pollutants contained in the flue gases of the vehicles[1]

Type of the vehicle		CO (g/km)	HC (g/km)	HC + NOx (g/km)	NOx (g/km)	PM (g/km)
Passenger vehicle	Conventional	5.9	-	3.0	-	0.25
	Euro I	2.72	-	1.13	-	0.18
	Euro II	1.0	-	0.7	-	0.08
	Euro III	0.64	-	0.56	0.50	0.05
Trucks and buses	Euro I	4.5	1.1	-	8.0	0.612-0.36

[1] U. S. Environmental Protection Agency. Automobile Emissions: An Overview. Fact Sheet OMS-5. August 1994. www.fhwa.dot.gov/environment/aqfactbk/page15.htm

Table 2 Potential impacts on the environment and population during preliminary works and construction phase of the project

Preliminary works and construction phase of the project
On water: ▪ Construction works (mining, deep excavation, demolition and removal of topsoil etc.). In that way, the disturbances of the natural recharge paths are possible, and at the same time by the removal of the topsoil and by the creation of the new drainage areas, the muddy water or in some other way polluted water drains fast into the ground. ▪ Construction machines – potential danger from spilling or accidental outpouring of the oil and oil derivates, disposal of the motor oils and similar waste. ▪ Uncontrolled disposal of excavated material. ▪ Use of inadequate material for construction. ▪ Uncontrolled drainage of sanitary water and of polluted rainfall water.
On air quality: ▪ Air pollution caused by dust from trucks used for transport of material or which are driven over the macadam roads and the smoke and the exhaust gases from the construction machines
On visual values: ▪ Impact develops from the cutting of the slopes and construction of the embankment.
On the use and organization of the space: ▪ Certain negative impacts can appear during construction phase of the project due to difficult access to the private parcels during construction, and large number of the construction machines, which will, in relatively short period of time, be located in a restricted – narrow area of the project.
On cultural and historical heritage: ▪ Cultural and historical heritage in the area of the project can be directly endangered by the construction of the road.
Impact on flora and vegetation: ▪ Flora and fauna habitats will be disturbed during the establishment of the construction sites, work areas and temporary disposal locations of the material. The entire process will largely contribute to the loss of the primarily vegetation cover as the main habitat of the animal species. ▪ Heavy machines used during such works cause compaction of the land (disturbance of the pedofauna), by which the water balance has been disturbed in deeper layers what limits the growth of the plant species. After the finalization of the works, the stamped habitats will be settled by the plant species with the well developed root system which is characteristic for the vegetation of stamped habitats.
Impact on fauna: ▪ Due to active presence of anthropogenic factor, the animal species mainly leave their habitats and go deeper into the ecosystem.
Impact on soil and agricultural land: ▪ Change of the purpose of the soil. ▪ Splitting into the smaller parcels - subdivision
Impact on infrastructure: ▪ Interruption of the existing traffic movement in the area.
Impact on noise level: ▪ Increase of the noise level due to the mining and operation of heavy machines
Impact on natural resources: ▪ Lack of the earth material for the embankment results in the need for opening of borrow pits.
Risk of accidents: ▪ Possible spilling of fuel, oils and lubricants

Table 3 Potential impacts of roads on the environment and population during exploitation of the project

Exploitation of the project
On water: ▪ Pollution of the rainfall water which falls on the road due to the leaks from the driving and lubricating systems (petrol, oil, motor oil, liquid for cooling and breaks), residues of tires and products of wearing of the wearing course (residues of the asphalt and bitumen), emission of the combustion products of fuel (lead and lead compounds, no combusted hydrocarbons, nitrogen oxides, soot and tar). ▪ Accidental pollution caused by traffic accidents. Accidental situations cause the spilling and leaking of harmful and dangerous material. The most common accidents are those that cause spilling of oil derivatives which have large capacity of diffusion into the soil and underground. Due to the complexity of flow and retaining of water in the ground, the pollution caused by oil derivates has long-term effects. Pollution can be activated in different hydrological conditions.
On air quality: ▪ Air pollution caused by the components which are the products of combustion due to the operation of the engine. The largest impact of the traffic is from the concentrations of the nitrogen oxides.
On cultural and historical heritage: ▪ If the construction of this road results in presentation of certain sites of cultural and historical heritage, which has not existed earlier, it may be said that positive impact on heritage has been achieved.
Impact on flora and vegetation: ▪ Area of the construction is under the impact of the exhaust gases on the plant communities
Impact on soil and agricultural land: ▪ Emission of harmful substances into the space around the road leads to reduction of use of soil production potential in the zone of 30 meters on each side of the road.
Impact on noise level: ▪ Increase of the noise level caused by the traffic
Risk of accidents: ▪ The first group of possible risks is present in all situations when planned environmental protection measures have been proved unsuccessful in the exploitation phase. ▪ The second group of possible risks is related to the accidental situations which can happen in the construction phase and maintenance works within the exploitation phase. ▪ The third group of possible risks is related to accidental situations as a consequence of a traffic accident which involved vehicles transporting dangerous substances. ▪ The fourth group of possible risks appears as the consequence of natural disasters in the form of floods and earthquakes.
Positive impacts: ▪ Increasing the traffic safety – road has been designed for the high standard of traffic.

4 DESCRIPTION OF THE ENVIRONMENT ON WHICH THE PROJECT HAS/CAN HAVE THE IMPACT

4.1 Climate and meteorological characteristics

Climate factor presents the significant factor in definition of the conditions for the construction of the designed road, especially in winter period, with the low temperatures.

At the wider research area, the moderate mountain climate is prevailing. That climate is characterized by moderate warm summers with the very changeable weather conditions, cold and long winters and short transitional periods out of which the autumn is warmer then the spring. Annual temperature variations of air range from 20 to 21 °C, and the average annual temperature of the air in the are of Kladanj is lower then 10 °C and ranges from 6.5 °C in the are of Karaula, to 9.8 °C, in Kladanj. In this climate zone, there is smaller number of summer days, with the temperature of air over 25 °C and significantly larger number of icy days with the air temperature below 0°C. Maximal number of summer days, with the air temperature over 25 °C, is 40-50, and the number of icy days with the air temperature below 0°C, 50-70 days, so it can be calculated that the relation between summer and winter days is 1:1 to 1.5:1 for the benefit of winter days. The average annual precipitation is 900-1000 mm of deposit. In the structure of the precipitation, the significant part is the snow precipitation. The precipitation schedule is very changeable during the year, although its quantity and distribution zone increases with the increase of the sea level. On the basis of the mentioned data, it can be concluded that only in the extremely unfavourable winter conditions, the construction works will not be possible to carry out along the designed alignment for some 30-40 days. Large variability of the climate elements in the tectonic crushed rocky masses present the significant agent of the rock decomposing in the surface conditions, what is especially visible in gabbros and sediment rocks of volcanogenic sediment formations (VSF).

4.2 Geomorphological characteristics of the terrain

Geomorphologic structure of the terrain in the wider surroundings around the road alignment is relatively simple, with regard to that three genetic categories of the relief are separated along the considered corridor:

- fluvial – accumulation relief,
- erosion – denudation relief, and
- karst – erosion relief.

Fluvial – accumulation relief is present within the plateaus along the valley of Ujića, Duboki potok, Blizanci, Bilova and Bukovica, while the erosion – denudation and karst – erosion relief, take the significant area on slope parts of the terrain built from the volcanogenic sediment formation of Jurassic age, magmatic rocks and limestone. Immediately along the riverbeds of the mentioned rivers, there are smaller plateaus, with the very steep longitudinal slope in the direction of drainage of rivers, as a result of accumulation of material by the spring-torrent regime of transportation of decomposing products in hydrological periods with the more abundant precipitation. Sides of the valley are relatively steep and built from the magmatic rocks. Fluvial – accumulation presents the favorable environment for road construction, because during preliminary phase for the construction it will not be necessary to carry out the preliminary planning of the terrain and carry out the earth works of larger extent and also the simultaneous opening is possible on several locations without the special conditions and limits.

Erosion – denudation relief is represented on slope part of the terrain. It has been built from the sediment rocks of volcanogenic – sediment formation of medium to upper Jurassic age, as well as base magmatic rocks. The relief of this category has characteristics of morphological jaggedness, dividedness and expanded drainage network of permanent and temporary watercourses, of centrifugal and dendritic type, which drain into the surface water. The sides of the slope are mildly inclined, the saddles are spacious and in the form of plateau, and the bottoms of valleys of the permanent and temporary courses are widened. In the area of Kladanj, on the right bank of the Ujiča River, the morphology of the terrain is uneven with a number of belly-like bumps, shallow oval recesses, smaller gliding terrace plateaus and occurrence of springs and softened areas, which ambiguously show the traces of gliding activity in early phases of formation of the slope. On the basis of the statements, it can be said that the delapsion processes also had the significant role in the formation of the today relief, in addition to the erosion-denudation processes.

Karstic-erosion relief is presented in the Canyon of Ujića River. It has been formed from the limestone of the middle Triassic. It has the characteristics of steep hardly accessible slope sides of the canyon and gorge type. In higher areas of the terrain, they form the spacious plateau with the significant milder slopes and less visible deleveling. The riverbed of Ujića River is deeply cut into the limestone massif along the fissure of the direction north-south, with which the limestone of the middle Triassic brought to the same level with the sediments of Jurassic volcanogenic-sediment formation. Valley bottom is very narrow, and the sides of the valley of the river directly are pulled out from the riverbed..

4.3 Geological and hydrogeological characteristics

The detailed study on the engineering-geology and geotechnical research works on the alignment of the main road, the section Kladanj – Paklenik has been prepared by the «Geotehnos» Company from Sarajevo. Geotechnical interpretation has been prepared with the modest program of engineering-geological researches, and because of that the geotechnical interpretations which has been given in the detailed study are based on the experiences and rather rough evaluation. Because of that, it is necessary to ensure the permanent geological-geotechnical control during the construction works in order to carry out the additional necessary investigation works and perform the necessary corrections.

In the engineering-geological sense, along the road alignment, the following categories of the cover and substrate have been separated:

- Technogenic cover
- Proluvial cover
- Eluvial-deluvial
- Geological substrate.

According to the material content within the technogenic cover, the following lithological elements have been separated:

- Dark brown to brown sandy clays mixed with the crushed gabbro-dolerit, amphiboles gabbros and limestone;

- Crushed gabbro-dolerit is mixed with the sandy-clayey fraction

Proluvial cover is separated in the riverbeds of Bukovica, Duboki potok, Bilova and Blizanci, in the form of continuous cover along the bottom of the valleys of the mentioned watercourses. It has been formed by the torrent regime and by the transportation and accumulation of the product of dissolving of the foundation rocks. In the sense of the material composition of the sandy-dust clay mixed with the crushed gabbro-dolerit and amphiboles gabbros, more rare the limestone and larger isolated blocks which float in the clayey material. Engineering-geological characteristics of this cover have been evaluated as very unfavorable.

Eluvium-diluvial cover is separated on the slope parts of the terrain as the residual cover over the volcanogenic-sediment formation and basic magmatic rocks of Jurassic age.

Colluviums ahs been developed by the physical disintegration of the limestone in the hypsometric higher parts of the slope and gravitationally transport of the disintegration products.

With regard to large tectonic pattern and surface disintegration, two engineering-geological units have been separated of the substrate: crust of the disintegration and undisturbed geological substrate.

At the are of the profile of the alignment P1 – P37, the four landslides have been defined, on the relatively small distances. In order to apply the stability measures of the alignment, it is necessary to carry out the additional investigation works to define in details dissemination and the character of these landslides. The safety measures for the stability of the alignment can be defined only after the carrying out of the additional investigation works.

At the beginning of the alignment, between the profiles P-2 and P-7 there is landslide 1. The landslide is of the consecutive type, what means that the erosion of the soil developed along the contact surface cover and geological substrate. Currently the landslide is settled down, but because of the possibility of cutting of the slope during the carrying out of the earth works, the sliding process can be activated again here, what should be avoided in any case.

Landslide 2 is located between the profiles P-10 and P-11. the landslide does not endanger directly the planned alignment, but its bottom is located in the immediate vicinity. The landslide is of the consecutive type, settled down and for now there are no any signs of the movement of the soil.

Landslide 3 is located at the planned alignment from the profile P-11 to P-19. During the phase of carrying out the earth works, the care has to be taken in cutting or excessively load of the slope from the embankment, in order not to disturb the natural balance, since these works can significantly disturb the general and local stability of this part of the slope.

Landslide 4 is located at the largest surface along the slope and stretches from P-20 to P-37. The landslide is of the frontal type considering the form, and according to the structure of the natural slope and the character of the movement, is of the insequential type, with the movements which developed not only along the contact cover-substrate, but also in the crust of the disintegration of the geological substrate. The landslide is currently settled down with the typical sliding morphology without any visible manifestations of the activities, and the instability processes develop in the form of easy movements of the earth masses, of the creeping of the soil in the eluvium-diluvium cover which lies directly over the sediment rocks. Construction on this landslide requests the special caution to prevent the activation of the landslide of larger size with carrying out of the earth works.

From the profile P-38 to P-81, the engineering-geological characteristics of the terrain are very favorable, this is area of the limestone which is relatively cracked and the road construction in this stretch can be carried out without larger problems.

From the profile P-115 to P-139, geology is conditionally stable (large depth of eluvium-diluvium covers) what means that all works must be carried out carefully with the certain conditions of construction works and materials which is incorporated into the body of the road. Because of that, it is necessary that the contractor is careful in accordance with the conditions from the Book II of the Main Design , and with the periodically consultations of the experts for geology and designers.

From the profile P-139 to the saddle tunnel Karaula on the profile P-173, the alignment is located at the conditionally stable terrain. In this part up to the saddle, it is necessary to take great care of the construction works, and that with any inadequate cuttings and construction works, in order not to cause the tearing off of the soil and occurrence of the landslide.

Stretch from the tunnel Karaula up to the end of the section is under the mines and is largely inaccessible, so that the geological investigations have not been done in this part of the terrain, but the presentation has been given on the basis of the previous investigations and maps. Only after the demining and arrangement of the soil, as well as the investigations works which must be carried out directly in the terrain, the real presentation on engineering-geological characteristics of the terrain will be possible to be given.

4.4 Hydrographic characteristics and its hydrological attributes

Water occurrence on the location of the section Kladanj - Paklenik

Thanks to the morphological characteristics of the terrain, the saddle Karaula presents the watershed which separates the local drainage areas of the Ujića River, tributary Spreča and Bjelave spring, which is the tributary of Stupčanica River. Ujića River flows up to the north, and with the tributary of Bukovica River and a number of smaller springs present the main watercourse for drainage of the surface water from the area of Karaula towards Kladanj. From Karaula towards Paklenik, the main watercourse is Bjelava River, the tributary of Stupčanica River, which together with the tributaries Blizanci and Duboki potok present the basic hydrographic network for the drainage of surface water towards Paklenik. The abundance of the mentioned watercourses is very changeable, depending of the general hydrological conditions during the year, ant the measured discharges oscillate in very wide range. It is necessary to mention that all mentioned watercourses mainly of the torrent character and that during the large precipitations they transport large quantities of drafted, produced or suspended deposits

4.5 Air quality

There is no data on air quality on the area where the road alignment of the high speed road passes. In the benefit of the evaluation of the air quality status, it is necessary to point out that most of the industry in Kladanj currently is not in function, and that the remained part of the alignment passes through the are where there is no larger industrial companies, so that the air can be considered as clean. Morphology of the terrain through which the planned alignment passes, enables the stronger natural air circulation.

4.6 Soil and agricultural land

Categorization of the agricultural land

Definition of the bonity categories of the land is carried out on the basis of the morphological, chemical, physical and biological characteristics of the soil, as well as the production characteristics of the terrain. The term bonity of the soil means the relative evaluation of the soil quality and its production capability, which value has been given in points from 1 to100.

The defined bonity categories of the agricultural land according to the use value have been put into three groups:

- Land adequate for cultivation (I-IV bonity category)
- Land less adequate for cultivation (V-VI bonity category)
- Land limited for use (VII-VIII bonity category)

The Physical Plan of Tuzla Canton defines the bonity categories of the land per municipalities.

Municipality Kladanj has 5,103.58 ha of agricultural land, out of which 84.15 ha (1.65%) is of third bonity category, 212.04 ha (4.15%) is of fifth bonity category, 3,271.28 ha (64.10%) is of sixth bonity category, 1523.32 ha id of seventh bonity category (29.85%) and 12.80 ha is of eight bonity category (0.25%).

Part of the land with good quality which are first three categories (I-III) is small, and the first two categories are not represented at all in this area, and the third bonity category land is present with 1.65% out of total agricultural land of Municipality of Kladanj.

Bonity categories of land are put into three agrozones and the agricultural land of Municipality of Kladanj as follows: 84.15 ha (1.65%) belongs to agrozone I, 3,483.32 ha (68.25%) belongs to agrozone II and 1,536.12 ha (30.1%) belongs to the agrozone III.

Agrozone II is consisted of types of the soil such as mountain fertile soil, brown soil on the limestone. These soils are characterized by the small depth of the solum, so in larger slopes they are strongly exposed to the erosion processes. With the previously lacks, the basic obstacle is difficult use of the construction machines for more intensive farming production in these soils.

Agrozone – III is mostly present with the mountain fertile soil and brown soil on the limestone. It is mostly present in Municipality of Kladanj 1,536.12 ha, i.e. 30.10% of the total area of this zone in Tuzla Canton.

Arable and untilled land according to the purpose

In the municipality of Kladanj, the following categories are present out of the total 5,103.58 ha of agricultural land:

- 1,011.132 ha of tillage,
- 136.495 ha of orchards,
- 2,777.26 ha of meadows,
- 3.924.891 ha of arable land and
- 1,178.693 ha of pastures.

The fact itself that on the area of Tuzla canton, the relation between available arable and agricultural land per capita continuously reduces from year to year, and that the processes of damage and extermination of the soil are still present on these areas, shows that the urgent measures are necessary to prevent further reduction of the land resources.

Due to the uncontrolled damage of the land (chemical industry, exploitation of the raw materials and construction of structures), relation of the available arable and agricultural areas per capita in the area of Tuzla Canton has been further reduced every day. In Tuzla Canton, tillage per capita presents 0.14ha, what is considered as enough for the food insurance, but should not fall below this limit.

IN the area of Municipality Kladanj, 59.02 ha of agricultural land are in the state ownership, while 5,044.56 ha are in the private ownership.

It is significant to mention that the private land parcels are largely split what contributes to the low level of the parcel productivity and limitation of the possibility of the farmer to accept modern management systems. Before the war, the program of redistribution o land and redistribution of fields existed, and the aim of that program was enlargement of the land parcels. In this way, the complexes of state agricultural land have been developed.

The land is spacious resource from which the existence and fate of the mankind depends, so that its use in the world is regulated and subordinated to the common interest of the society. The agricultural land presents the biggest value within that resource, and because of that, it should be saved to the greatest extent from the use in other purposes or especially from permanent losses.

Stopping the trend of losses of the most qualitative agricultural soils and the issuance of the Plan of Land Use should be one of the strategic tasks of Tuzla Canton, and until then, the data on dissemination per individual agrozones will be of use for the Plan of the Use of Agricultural Land.

In accordance with that, in Municipality of Kladanj, due to the large representation of the second and third agrozone and the climate conditions, it is necessary to introduce the semi-intensive production on the basis of healthy food and incentives for the rural entrepreneurship: collection of herbal plants, cattle rising, fruit growing (strawberry type fruits – raspberry and strawberry) and beekeeping.

Differences between the agrozones reflect in primarily production capabilities of the land as well as in conditions of production and ways of its production use.

Formation of the regions of the area of Tuzla Canton in relation to the representation of the sea levels of the terrain and total agricultural land shows that first agrozone is related to mainly plain and mildly uneven terrains, second agrozone for hilly and rarer mountain terrains, and the third agrozone for the mountain terrains.

With the review of the Physical Plan of the Zenica-Doboj Canton, it is visible that the alignment of the high speed road passes almost through the entire part over the area, where the Physical Plan defines the temporary unused areas since the terrain is under the mines. The remained part of the alignment passes over the forest land.

And for the part of the terrain which belongs to Tuzla Canton on the part of the alignment from the saddle Karaula and all the way up to the Paklenik, the terrain is under the mines due to the war activities.

4.7 Flora and fauna

On the section of the road Kladanj-Paklenik, two areas can be separated from the view of representation of vegetation. At the beginning of the alignment near Kladanj, at the mildly uneven hilly area, the terrain is bare with the grass cover with the rare shrub vegetation, while at the smaller area, the parcels which are used as fertile soil of different bonity categories are present, among which the parcels for the production of the agricultures dominate. At the area from Bukovica River, which is the tributary of Ujića River up to Paklenik, the terrain near the alignment is covered with the forest. According to the available data, in higher areas above 600 meters above sea level, the beech forest is prevailing, where besides the beech, the maple also appears as well as hornbeam, and with the increasing of the height, the conifers are present among which fir, spruce and pine.

According to the data given by the Public Company "Forest Commercial Association of Zenica-Doboj Canton" Economic Unit Forestry Olovo, the proposed alignment of the road passes through the high forests as follows:

- Forest class 1221 – high forests of beech and fir with spruce on the deep acid-brown soil on the silicate substrate,
- Forest class 1205 – high forests of beech and fir with spruce on primarily deep soils over the limestone and
- Forest class 1233 . high forests of beech and fir with spruce and other forests in the succession with the forests of beech, fir with spruce on deep soils on gabbro and diabase.

Covering of the terrain by the vegetation cover significantly improves the soil structure in the surface part of terrains, because its capability of absorption of atmospheric water is increasing as well as resistance to the erosion processes, comparing to the bare areas, where those processes are much stressed. During construction works in the certain parts of the alignment, the preliminary clearing away of the wood mass will be necessary as well as removal of roots, what presents the additional obligation in carrying out the earth works during preparation of terrain for the construction of the road.

Mined area in all categories of the forests and forest land present big problem in total management.

At the area of the plateau Kovačići and lower, the proposed alignment is laid down directly near the area where the endemic plant narcissus (sunovrat) is present.

Considering the fauna, this area is extremely rich with and settled by almost all types which are present in B&H region, such as Bosnian brown bear, black grouse or gluhan, Balcan chamois, deer, wild boar, wolf, fox, wildcat, pine marten, skunk, weasel, otter, badger, plain rabbit, squirrel, dormouse, hazel hen, hawk, owl, grey crow, raven, magpie, wild pigeons. At the concerned section, a number of paths are present of movement of wild animals which for a long time with generations use the same paths for moving. In the area along the alignment, there are two isolated areas, i.e. areas of controlled growing of animals where hunting is prohibited. One of the areas which are located in the Municipality of Olovo includes Stara karaula, Jezera, Seline, Veliki Hrastik, Radava River, all the way up the Smoljenci. The other, located in the area of Municipality of Kladanj, include the area of Aleksići to Karaula. These data given by the hunting associations from this area describes in clear way that almost entire area of the road alignment after the exit from Kladanj passes through the area which is significant for the growing of the wild animals, and in accordance with that, the significant migration of animals can be expected over the road alignment.

The alignment is laid down near the Ujića River, and it passes over the Bukovica River which both are already established long with centuries natural reproduction places, for which according to the Law on fresh water fishing of FB&H the prohibition is defined for excavation of pebbles, stone, cutting of woods, etc. Because this is the sensitive eco system where the disturbance of natural characteristics of reproduction sites is permanently prohibited. Also, in the area of Municipality of Olovo, the alignment goes along the Bjelava River, which is rich with trout, grayling, huchen (mladica) and other fish species.

4.8 Protected parts of the nature

In accordance with the Physical Plan of Tuzla Canton in the sense of the natural heritage, the following categories have been defined:

- natural areas and
- Natural values.

Within the natural areas, there are :

- Areas of valued landscape (landscapes),
- landscape-park areas (parks),
- Natural values, hydrographic, geo- morphologic, flora and fauna.

In the area where the road alignment passes, there are two protected landscapes:

- The area of Karaula (Kladanj),
- The Canyon of Ujća river (Kladanj), canyon area from the restaurant building "Jelen" to the location of Mimoza,

Landscape-park area

- Natural area "Babovac" (Kladanj)

Geomorphology

• Bebrava cave, (Kladanj)

Considering that the significant natural and cultural and historical heritage is present, the development of the Municipality of Kladanj will be based mostly on tourism development in the future.

4.9 Cultural-historical heritage

The area of the Municipality of Kladanj is extremely rich with the cultural and historical monuments from all eras. The remains of the material culture of the early times are located on a number of locations.

The Municipality of Kladanj is consisted of valued cultural and historical and also natural heritage where there are over 50 locations of tombstones (stećaka) with 142 structures. Valuable historic area is consisted of necropolis Bijeli Hrid Tuholj with 18 tombstones (stećaka), as well as necropolis Gojsalići with 46 tombstones (stećaka), Ljuto brdo with 25, Brateljevići that are placed on a list of Commission for national monuments , necropolis Mramorje-Olovci with 22 tombstones (stećaka), necropolis Obori with 17 tombstones (stećaka), and necropolis Olovci which is declared as national monument. Valuable area is consisted of necropolis of tombstones (stećaka) Vijenac, Gojakovići with

15 tombstones (stećaka), Brgovine- Noćajevići with 27 tombstones (stećaka) and Gvozdenovići with 28 tombstones (stećaka) as well as necropolis Mramorje- Pelemići with 22 tombstones (stećka). Within Kladanj itself valuable area is consisted of center of old part of the city together with Kuršumlija or Hadži Bali-begova Mosque and nearby Hadži Đurđihan hanumina fountain where old part of the city was originally developed. Integral part of the cultural, historical and natural valuables is complex of water mills on river starting from Brateljevići, over Kladanj to Obrčevci and Starići.

Also, in the Municipality of Olovo, the following cultural and historical heritage has been recorded:

- Necropolis with the tombstones in the location of "Mramorje" in the village Moguš, the historical area
- Necropolis with he tombstones in the location Navitak in the village Boganovići, the historical site

Old wooden mosque in Miljevići, the place and the remains of historical monument

4.10 Infrastructure

At the location under the bridge at the profile P118 and P119, there is gas installation which is not in direct collision with the road alignment. However, during the construction of the bridge, it is necessary to take care not to damage the gas installations by establishing the construction sites or by carrying out the works. Before any works, it is necessary to obtain the authorization from the BH gas Company.

Also, according to the unofficial data obtained at the field in the area of the plateau Kovačići and lower, the proposed alignment crosses over the pipelines of Sarajevo-gas Co. in two locations.

4.11 Mine threat

By the revision of the draft of the Physical Plan of Zenica-Doboj Canton, it is clear that the alignment of the high speed road passes almost fully through the part which is defined by the Physical Plan as temporary useless area due to the mines present in this terrain. Also, the part which is located in the Municipality Kladanj is under the mines. According to the available data, out of the total area of Municipality Kladanj which is 32,842.72 ha, 206.95 ha is under the mines and 210.11 ha is suspicious area, and the most part is just along the alignment of the planned road.

5 DESCRIPTION OF POSSIBLE SIGNIFICANT IMPACTS OF THE PROJECT ON ENVIRONMENT AND POPULATION AND PREVENTION/MITIGATION MEASURES

Impact	Impact significance	Prevention measures	Responsibilities
On waters			
During construction: ▪ Construction works (mining, deep excavations, demolition and removal of the natural cover layer and other). In that way, the disturbances of natural resources of fertilization are possible, and in the same time by removal of the covering layer and by creation of new drainage areas, the muddy water or in some other way polluted water drain fast into the ground. ▪ The construction machines – the potential danger from the spilling or accidental outpouring of oil and oil derivates, disposal of motor oil or similar waste. ▪ Uncontrolled disposal of excavated material, i.e. covering the riverbed of the watercourse with the excavated material or other construction works material. Especially considering that there will be significant surplus of the excavated material from the tunnel and cutting. Special danger in covering the riverbed presents the problem of reduction of its discharge capability what can have negative consequences in occurrence of the high flooding water. ▪ Disposal of different waste from the technological process of construction works complex sites on the banks of the river or directly into the riverbeds cause the pollution of water and spreading of the pollution along the watercourse. ▪ Use of inadequate materials for construction. ▪ Uncontrolled drainage of sanitary waters and polluted rainfall water. Due to the vicinity of the watercourse, the construction works of the concerned road can cause turbidity of the watercourse. Such occurrence is not permanent and after finalization of the construction works, such occurrences would be reduced, i.e. would disappear	The alignment of the planned road on the concerned section n Kladanj- Paklenik is not located within the defined water protection zones, so the negative impact on them is not expected. The alignment passes near and over the area of rich hydrograph, of which the Ujića River canyon presents the protected landscape**.** The impact on waters might be **significant**, so that it is necessary to strictly adhere to the listed measures of prevention and mitigation.	**During construction** ▪ Preparation of Waste Management Plan and Plan of Measures in the case of accidents. ▪ Preparation of the Organizational Project for the construction site with the adequate solutions of drainage and treatment of sanitary wastewaters, as well as rainfall water from the yon of the construction site. ▪ Disposal should not be done in the riverbed or along the banks of the river. ▪ All excavated material, which will not be immediately used in the construction works must be disposed on the locations planned for that in accordance with the Organizational Project of the construction site (dumpsite of the surplus of the material) protected from the occurrence of the erosion, as well as outside of the vicinity of the watercourse. ▪ To the maximum extent, preserve the vegetation cover, i.e. leave the buffer zones formed from the vegetation cover between the roads and watercourse. ▪ Near the watercourse use only clean material for the embankment, such as pebble, without presence of earth or other impurities. ▪ Protect the areas near the banks	**During construction** Contractor.

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Impact	Impact significance	Prevention measures	Responsibilities
with time with the application of necessary measures for the restoration of the excavation, as well as for the regular drainage. .		which are sensitive to the erosion by means of stabilization and with plants which prevent the erosion. ▪ Prohibit any temporary or permanent disposal of waste material on the surrounding soil, except on the area planned by the Organizational Project of the construction site, and insure the water impermeable containers for waste. ▪ Supervise the processes of formation of deposits, and organize cleaning of the bottom and the cutting of the riverbed form the surplus of the material. ▪ Carry out frequent and controlled management of the municipality and dangerous waste in prescribed way. ▪ Establish the continuous supervision during the construction works with the presence of the specialist for the environment protection. ▪ Sanction by discipline measures the violators of the established code of conduct. ▪ Accept the used water from the construction site with the adequate sewerage systems, collect them in the water impermeable reservoirs and treat them in the prescribed way (either on-site of off-site), and before discharge into the recipient or city sewerage system. ▪ At the locations of the construction	

Impact	Impact significance	Prevention measures	Responsibilities
		site, instalment of the eco toilets is mandatory for it is necessary to the workers. ▪ Ensure the areas with the water impermeable layer for the storage and servicing of the construction machines, outside of the defined sensitive zones. ▪ Collect the oiled rainfall water from the construction site in the water impermeable reservoirs and treat them in the prescribed way (either on-site or off-site), and before discharge into the recipient or the city sewerage system. ▪ All construction site areas and other impact zones are necessary to restore during the construction in accordance with the Plan for restoration, i.e. depending on the future use of the area put in the original state. ▪ In the case of accidents, spilling of the fuel or lubricants into the environment, the urgent intervention is necessary in accordance with the Plan for urgent interventions in the case of accidents..	
During exploitation: Pollution of the rainfall water which falls down on the road due to: ▪ Losses from the system for driving and lubricating (petrol, oil, motor oils, liquids for cooling and breakage), ▪ Waste of tires and products of the wearing of the surface layer (pieces of the asphalt and bitumen), ▪ Emission of combustion products of driving fuel		▪ In the zones near the watercourse, plan the closed system of surface drainage for the high speed road with the biological treatment instead of currently proposed system ▪ Protect the areas sensitive to erosion with the means of stabilization and plants which	Institution competent for the management of high speed road (FDR)

Impact	Impact significance	Prevention measures	Responsibilities
(lead and lead compounds, not fully combusted hydrocarbons, nitrogen oxides, soot and tar). Accidental pollution caused by the traffic accidents. Accidental situations cause spilling and spreading of the harmful and dangerous material, the most often accidents are the one where spreading of the oil derivates occur which have the large capability of diffusion into the terrain and the ground. Due to the complexity of flowing and retaining of the water in the ground, the pollution with the oil derivates has the character of long-term action. Pollution can activate in different hydrological conditions.		prevent the erosion. ▪ Prepare the Operational Plan for regular and special maintenance of the drainage system of the high speed road. This plan regulates the scope and time interval of the procedure of control, cleaning and if necessary repair of the structures for drainage system for rainfall water and structures for their treatment. ▪ Define by Plan the way of management of material created by the process of cleaning and maintenance of the drainage and treatment system in accordance with the Law on waste. Preparation of the Plan and its implementation is in the competence of the service for environment protection. ▪ Prepare the Operational Plan for the procedure of winter maintenance (use of salt and other agents for defrosting) taking care, in the first time, of water and soil protection, and then also of global problem of environment protection. The Plan should include: -definition of adequate locations and way of storage of chemicals which are used for maintenance of the high speed road, use of the chemicals should be reduced into minimum with the correct prognosis of the surface of the road state..	

Impact	Impact significance	Prevention measures	Responsibilities
On air quality			
During construction: ▪ Use of the construction works machines cause more significant emissions of pollutant into the air (CO, SO_2, soot), as well as "creation" of dust during work and movement of machines and vehicles. ▪ Use of mining for excavation in the rocky material – especially in open area (in the alignment, in quarries –borrow pits), and in tunnels in small extent cause the occurrence of emission of pollutants – explosive products (CO_2, oxides, acids) and large quantities of stone dust. **During exploitation**: ▪ Air pollution caused by the components which are products of combustion due to motor operation. The largest impact of traffic is concentration of nitrogen oxides. ▪ Concentration of pollutants along the alignment is condition of mainly size of the emission (density of the traffic, type of vehicle, driving regime, etc.), meteorological parameters (prevailing wind direction, climate conditions, existence of the vegetation along the road) and configuration of soil. Area where the largest negative impacts on air quality can be expected on the concerned section are the one that passes near the settlements, which are designed in the slopes or if they are located in the immediate vicinity of crossings or tunnel portals.	The alignment mainly passes through unsettled area so that the impact during construction is minimal, and **potential impact is possible only in the settlement of Kladanj**.	▪ Install the filters for separation of soot at the exhaust pipes of all machines and vehicles with diesel engine. ▪ Ensure maximum validity and functionality of the combustion system for the driving fuel by regular (periodically and planned) and special inspection of the machines and vehicles, use (and regular control) the fuel – with the guaranteed standard of the quality. ▪ Prevent appearance of the dust, which regularly appears at the temporary construction sites of the roads by periodically sprinkling the surface of the road and working areas with water. ▪ In the case of use of mining for the excavation in the rocky massif, select the type of the explosive, which has the least harmful impact for the environment.	The Contractor
On soil and agricultural land			
During construction Roads have the multiple impacts on the agricultural soils and agricultural ecosystems in its immediate vicinity, and wider as well. The largest and irreversible damage to the soil is permanent change of the purpose	The significant impact **is not expected** on soil and agricultural land since the planned alignment passes	▪ Considering the soil along the roads All manipulation with the petroleum and its derivates in the construction process, the supply of the	The Contractor

Impact	Impact significance	Prevention measures	Responsibilities
of the soil, because of that are being completely and forever excluded from the plant-agricultural and forest production. It should be taken into consideration that the soil is the limited natural resource of the exceptional importance. Although the damage caused by change of the purpose cannot be restored, it cannot be avoided. But, what can be done, it is to choose the variant of the alignment with which the soils with the most important value will be avoided. It has been taken into account during construction of the alignment of the bypass. With the construction of the alignment, the contact with the agricultural land should be avoided, in the case of present collisions by the procedure of fair compensation and it is necessary to solve this problem through the expropriation, which could not be fully avoided. Other type of the damage is splitting the parcels-subdivision. Request for the efficient development of traffic is often in collision with the request that the land parcels intended for agricultural production should be as less as possible split and consequently subdivided in that way. During the construction works for the alignment, the erosion will also appear due to removal of vegetation and cutting of the land. During the construction, the contamination of land can also appear due to the use of the construction machines because of spilling of oil, lubricants and fuels, and what would reflect in the form of organic pollutants, presence of different hydrocarbons, etc.	mainly through the areas which are currently not used considering that those areas are under the mines.	machines, is necessary to carry out with the maximum measures of protection in order to prevent the spilling. All packaging material fir oil and other derivates of petroleum must be collected and dispose on the controlled landfills of the contractor from where it is taken away in controlled manner by the authorized waste municipality company. ▪ The parking of the machines must be done only on the regulated locations. At the locations of parking of the machines, take the special measures of protection form the pollution of the soil with the oil, petroleum and its derivates. If the soil pollution occurs by leaking of oil or in some other way that layer of earth is necessary to remove and deposit on the landfill. ▪ It is prohibited to wash the machines and vehicles in the construction work zone. ▪ During performing of the earth works, the humus lays should be deposited, protected from the pollution, and later use for regulation of the embankment and green zone along the road. ▪ All areas damaged by the construction works put into the original state, or regulate in horticultural way after the finalization of the works. ▪ For all borrow pits, the special	

Impact	Impact significance	Prevention measures	Responsibilities
		restoration projects must be prepared in order to prevent the degradation of the larger areas of soil.	
During exploitation: The contamination of the soil can happen during the exploitation of the high speed road due to exhaust gases, tire wearing and maintenance of the road what reflects through: ▪ Organic pollutants, presence of different hydrocarbons, ▪ Heavy metals, especially lead, zinc and cadmium, ▪ Presence of the salt, which is used during the winter period for prevention of the glazed frost.		▪ Protection measures during exploitation are reduced to regularly maintenance of drainage system, wind protection zones and protection fence.	Institution competent for the management of “high speed road” (FRD)
On microclimate			
During construction: Change in microclimate in the zone and during the construction works will not be especially measurable except the air heating and pollutant emission into the air, what can cause the effect of "blurred" atmosphere and consequences in the form of higher air temperature in the narrow zone of the construction works sites.	Generally, all effects relate to the narrow area around the very alignment. It is necessary to consider that this impact is already present, and during the reconstruction of the road the increased impact is not expected.	There are no special measures for prevention/reduction of impacts.	
During exploitation: Asphalt surface is, in principle, the good recipient of the sunrays, so that the temperature of the surface of road and the ambient temperature are increased. That also	The impact is evaluated as **insignificant**.	There are no special measures for prevention/reduction of impacts.	

Impact	Impact significance	Prevention measures	Responsibilities
effects the reduction of the relative air humidity value on the mentioned area, as well as the evapo-transpiration.			
On flora and fauna			
During construction ▪ The plant and animal habitats will be disturbed due to the establishment of the construction site, work area and temporary dumpsites of the material. The entire process will largely contribute to the loss of primarily vegetation cover as the main habitat of the animal species. ▪ Heavy machines used during such works cause compacting of the soil (disturbance of the pedofauna), by which the water balance is disturbed in deeper layers what also limit the growth of the plant species. After the construction, the damaged habitats will be settled by the plant species with well developed root system which area characteristic for the vegetation of the stamped habitats. ▪ Animal's characteristic for such area under the noise impact will be driven away from their habitats. Impact of the exhausted gases (on the plant communities) will additionally have the negative impact on forest animals and reptiles, as well as the terrestrial insects. ▪ Due to the active presence of the anthropogenic factor, the animal species mainly leave their habitats and go deeper into the ecosystem.	Considering that the route passes mainly through the forest land with the valuable high forests, as well as the area rich with the wild animals with two large protected rivers, and it also is located near and it crosses the Ujića River which is natural fertilizer, impact on flora and fauna is evaluated as **significant**.	A number of bridges and tunnels have been planned by the project in the area of the mentioned hunting reservates, what can be considered as favourable solution from the aspect of protection of flora and fauna.	The Contractor
During exploitation: ▪ Impact of the exhaust gases on the plant	Considering the above-	In case of the determination of more significant number of collisions with the	Institution competent for

Impact	Impact significance	Prevention measures	Responsibilities
communities ▪ Death of animals	mentioned, the impact has been characterized as insignificant, but the prevention measures should be applied yet.	animals during the first year of exploitation of high speed road, the developer will, for the further exploitation phase in the critical sections and respecting the construction requests, insure the construction of necessary number of passages and underpasses to ensure the crossing of the terrestrial animals under the high speed road, as well as insure the installation of wire fence with the minimum size of openings, and also the adequate and for birds visible protection barriers for prevention of their low flight.	management of high speed road (FRD)
Impact on landscape			
During construction ▪ Considering the general observation of the area where the planned alignment passes through, as well as the planned elements, it has been evaluated that planned project does not have larger negative impact from the aspect of reduction of aesthetic values of the area. Namely, the applied technical elements of the alignment are mutually harmonized, so hat the entire view of the alignment is pleasing. ▪ Taking into consideration that the terrain on this section is very exposed from each side, it is necessary to take care on the aesthetic side of the project that is the formation of the lower layer, as well as the horticultural arrangement of the wider environment.	Insignificant, but it is still necessary to apply the protection measures.	▪ In end phases of the project solution it is necessary to prepare the project of landscape arrangement. ▪ The disturbance of the natural ambient in large extent is not possible to avoid with the construction works in the alignment of the road. Because of that it is recommended that the construction works should be done with the large care, in order to use the land as less as possible. In the entire alignment during the construction works, it should be taken care to use the existing road network, with as less as possible construction of new roads for the needs of the construction site.	The Contractor

Impact	Impact significance	Prevention measures	Responsibilities
		▪ Constructor should remove the fertile soil during the excavation and dispose it on the location which is planned for that purpose. Excavated and temporary deposited fertile soil should be used later in horticultural arrangement of the road alignment. ▪ After the finalization of the construction works, all area of the construction site and other zones of the temporary impact should be restored, i.e. depending on the future use of the area (agricultural land, natural vegetation) put it into the original state.	
Impact on the protected parts of the nature			
The planned alignment is located near the two protected landscapes, i.e. the area of Karaula, as well as the Canyon of Ujća River. Most of the alignment in Karaula area passes through tunnels, while technical solution for the construction to overpass the canyon was not known at the moment of preparation of EIA study.	The impact on Karaula is assessed as lees significant while impact on canyon might be significant.	The overpass design must take into account river sensitivity so it should not be funded at the river bad or bank.	Designer +FRD
Impact to the cultural-historical heritage			
During construction: ▪ According to the available data, there is no direct collision of the alignment with the protected cultural and historical heritage. However, taking into consideration that this is the area of rich cultural and historical heritage, as well as that the precise	Impact is evaluated as potential.	▪ It is necessary to ensure the presence of the expert form the field of cultural-historical heritage during the laying down of the alignment of the road, in order to avoid the	The Contractor

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Impact	Impact significance	Prevention measures	Responsibilities
locations of this values were not explored until today, it can be stated that the danger exists for the cultural and historical heritage in the area of the project to be directly endangered by the construction of the section, so that in accordance with that, the contractor must strictly adhere to the proposed measures.		physical damage of the cultural heritage. ▪ Any activity that could damage the cultural-historical heritage (taking the material, depositing the material, manipulative movement of the machines and similar) must be prevented by organization of the construction site in the diameter of approx. 50 m from the archeological excavation. ▪ If during the construction works some archeological findings or indications of cultural-historical heritage structure are possible discovered, it is necessary to stop the works and inform the competent institution about that.	
During exploitation: ▪ Exploitation of the road has no negative impacts on archeological excavations if protection measures are applied during the construction works of the project. ▪ If the presentation of certain locations or structures of cultural-historical heritage should be insured during the construction works of the road, which up to date was not the case, it can be said that the positive impact on heritage is achieved.			
Impact on increasing the noise level			
Considering that this is mainly the unsettled area, it can be easily concluded that the project will not have the significant impact on increasing the existing noise level.	Insignificant, but it is necessary to apply the prevention measures.	▪ On parts of the construction site and also in the settlements, the works should be carried out only during the day. Only in the case	

Impact	Impact significance	Prevention measures	Responsibilities
In any case, after the finalization of the road, it is necessary to carry out the measurement of noise on significant locations, as well as prepare the model for spreading of the noise. In the case of increased values, it is necessary to define measures for protection against the noise.		when it is necessary, the works should be carried out in the evening or during the night. ▪ Protection measures are not necessary in this phase during the exploitation that is during the development of the traffic, however, the results of the monitoring during the exploitation will give the basis for possible corrections.	
Impact on infrastructure			
During the construction Considering that the alignment crosses over many locations or partially the existing road, the interruption of traffic can happen during construction Near the alignment there is only one bigger settlement (Kladanj), so that there is no larger number of connections fir roads and city streets, and during the construction the significant negative impact can not occur on the interruption of existing capability of traffic movement in the area. The alignment is located near and crosses over the gas installations, where in case of not adhering to the measures of prevention, these infrastructures could be damaged.	Significant; it is necessary to apply the impact prevention/reduction measures.	▪ In the places where the new designed alignment crosses or it is partially on the existing road, take care of the solution that the traffic can be developed during the construction works. ▪ Displace the pipes through the preliminary works at the places of collision with the existing installations; i.e. select/protect/isolate the pipes by technical measures. ▪ At the places of the collision with the existing roads, it is necessary to carry out the necessary temporary protective constructions which will separate the roads from the construction works zone; apply all prescribed traffic signalization and if necessary insure the traffic police patrols.	The Contractor

Impact	Impact significance	Prevention measures	Responsibilities
Impact to inhabitants and population (social impacts)			
During construction During the construction works of the project, the certain negative impacts can appear due to difficult access to the private lots, and as well due to the large number of the construction machines which will be located in relatively short period of time on the limited-narrow area of the project.	Impact is evaluated as insignificant, but it is necessary to apply the prevention/mitigation measures.	Limit movement of heavy construction machines during the construction of the road, in order to make the surface of the soil devastated by the works as less as possible, i.e. use the existing road network which after the finalization of the works should be restored.	The Contractor
During exploitation The faster and safer connection of two cities, Sarajevo and Tuzla will be ensured by the construction of this road.			
On use and organization of the space			
On the basis of the expert opinion given by the Ministry of Physical Planning and Environment protection of Tuzla Canton, the concept idea of the alignment somewhat deviates from the alignment planned by the Physical Plan of the Canton, what is acceptable from the aspect of physical planning because only through the preparation of the more detailed documentation (conceptual design and main design), can precisely define the alignment of the road, which will be implemented into the Physical Plan of the Canton if the agreement has been achieved and after the final adoption of the alignment. However, the construction of bypass is planned around the urban area of Kladanj by the Physical Plan, while the proposed alignment mainly stretches along the existing main road. Here it is necessary to carry out the additional analysis and harmonize the interests also with the Municipality Kladanj, which has the obligation to precisely draw in the new alignment of the road into the Physical Plan of the Municipality which preparation is ongoing.	**Impact is evaluated as significant**	It is necessary to consider the possibility of construction of bypass of Kladanj.	Developer/Federal Road Directorate, Municipality Kladanj

6 ALTERNATIVE SOLUTIONS AND DESCRIPTION OF THE REASONS DUE TO WHICH THE GIVEN SOLUTION HAS BEEN SELECTED CONSIDERING THE ENVIRONMENTAL PROTECTION ASPECT

Considering that this the section of the road Sarajevo –Tuzla which has in this moment extremely poor technical characteristics, the section has been already proclaimed as priority for reconstruction, so that the preparation of the adequate documentation for reconstruction started already in 1987.

So that the design engineering company «Divel», Ltd. Sarajevo has prepared the Conceptual design with several variants which have been elaborated in details, and the most favourable one has been selected and it has been confirmed in written by the revision commission with the proceedings No: 01-02-165-3/05. On the basis of the adopted variant, the designer has prepared the Main Design of the mentioned section.

Due to this, the consideration of the alternatives to the planned alignment of the road Kladanj-Paklenik in the context of environmental protection has been reduced to the alternative with the project implementation and alternative without the project implementation, since the improvements of the technical characteristics of the existing road alignment can be hardly achieved with not following the existing road corridor. Namely, the width of the protection zone for the main road is 20 m. The width of the protection zone has been calculated from the road belt to the each side of the road.

On the basis of the previously given argumentation, it can be said that the project implementation, that means the construction of the section Kladanj-Paklenik on the proposed alignment, would achieve the significant contribution of the improvement of safety of traffic between Tuzla and Sarajevo. On the other hand, the alternative without project implementation, would result with further difficult situation of communication between these cities.

7 INDICATIONS OF DIFFICULTIES IN PREPARATION OF EIA

The biggest difficulty in preparation of EIS draft presented inexistence of the data on a number of significant environmental aspects such as current air quality along the alignment of high speed road, precise locations of cultural and historical and natural heritage structures, and similar.

Also, the significant problem is inexistence of the physical Plan of the municipalities Kladanj and Olovo where the alignment passes through.

8 MONITORING SYSTEM WITH THE DETERMINATION OF METHODOLOGY

Monitoring in construction phase is related to the monitoring of implementation of environmental management provisions, i.e. monitoring of the operation of construction machines, manner of storage and handling of dangerous and harmful substances and monitoring of the implementation of Waste Management Plan.

With regard to the activity of material supply, the monitoring obligation is related to inspection, aiming to check whether the installations supplying the material have the official approval for operation. The objective of monitoring is to ensure that the installations satisfy the requirements related environment, health and safety. The contractor will, during the procedure for selection of construction material supplier, request from all potential candidates to submit valid environmental and operation permits.

Monitoring during transport of material is related to checking of the transport manner, and it will be implemented by the appointed person. The appointed person will visit the construction site on a daily basis and visually supervise the transport vehicles.

Monitoring of emissions from the construction site and state of environment in the construction zone is related to monitoring of noise, dust emissions to air, emissions of pollution to water. Other types of monitoring are related to the supervision of traffic on the construction site, aiming at safety of vehicles and pedestrians and securing of the alternative road where that is necessary.

Table 4 Programme for monitoring of emissions from construction site

Potential impact	Which parameters will be monitored?	Where the monitoring of the parameters will be carried out?	How the monitoring of the parameters will be done?	When the monitoring of the parameters will be carried out? (frequent measurement or continuous)	Cost Lump sum/weekly Km
a) Disturbance with the noise of the people, animals and workers	a) noise levels;	a) near the settlement	a) in accordance with the JUS U.J6.039	a) once in a month and according to complaints	200
b) Air pollution	b) Concentrations of the nitrogen oxides NO2, NO, Nox, Concentrations of the sulphur dioxide SO2 Concentrations of the suspended particles PM10	b) at the or near the construction site	b) in accordance with : BAS ISO 7996 Chemiluminiscent method BAS ISO 10498 Ultraviolet fluorescence method BAS ISO 10473 Method of absorption of β-rays	b) once in a month and according to complaints	800
g) Water and soil pollution with oils and lubricants, increasing the suspended particles in the watercourse, etc, and due to inadequate storage of the waste	g) Temperature, Turbidity, Electrical conductivity, pH, Dissolved oxygen, Total dissolved suspended particles, KMnO4 Sulphates, Solidity, Alkalinity, Heavy metals: Cr, Pb, Hg, Fe, Zn, Mineral oils	g) At the profiles of watercourses during the construction, as well as at the zero profile before the construction zone, and at the	g) standard physical chemical methods	i) once in a month during construction and according to complaints	2000

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Potential impact	Which parameters will be monitored?	Where the monitoring of the parameters will be carried out?	How the monitoring of the parameters will be done?	When the monitoring of the parameters will be carried out? (frequent measurement or continuous)	Cost Lump sum/weekly Km
material disposal, construction works in the watercourse and similar		final profile after the construction zone.			
i) Soil pollution due to spilling of oil and lubricants	i) water and soil quality (dissolved particles, organic compounds, lubricants, oils, defrosters, heavy metals, pH value, water conductivity. Work procedures	i) At the place of incident	i) Standard methods	i) In the case of incident	

Table 5 Monitoring of implementation of environmental management provisions

Phase	**Which** *parameter should be monitored?*	**Where** *should this parameter be monitored?*	**How** *should this parameter be monitored?/ type of monitoring equipment*	**When** *should this parameter be monitored? (frequency of measurements or continuously)*	Costs	Institutional responsibility for monitoring
Construction	**Construction site**					
Traffic interruption during construction works	Traffic movement	At or near the construction site	Inspection, observation and comparison with Contractor's statement about the method	Once a week during peak and non-peak periods	Not available	Contractor, Supervision engineer
Construction material supply	Ownership of official approvals or valid permits for operation	For all materials used during construction	Inspection	Before start of construction works	Not available	Contractor, Supervision engineer

Phase	**Which** *parameter should be monitored?*	**Where** *should this parameter be monitored?*	**How** *should this parameter be monitored?/ type of monitoring equipment*	**When** *should this parameter be monitored? (frequency of measurements or continuously)*	Costs	Institutional responsibility for monitoring
		works				
Water protection - danger from water pollution	Compliance of monitoring programme with the planned scope of tested parameters, sampling sites, sampling manner and frequency.	Runoff from the construction site alignment and structures	Inspection	Inspection once a week Unannounced inspection during construction works	Minimum, bill of costs	Contractor; FRD; Supervision engineer, Inspectorate for environment and water
	Completeness of the drainage system, washrooms and water treatment plant	On the site during construction works	Inspection	Inspection once a week during construction works Unannounced inspection during construction works	Minimum, Bill of costs	Contractor; FRD; Supervision engineer, Inspectorate for environment and water
Waste management	Prescribed transport, storage and disposal of waste and other aspects defined in the Waste Management Plan	Disposal sites; camps for workers, construction site	Inspection, supervision	On a weekly basis during construction works and depending on complaints, in order to ensure that the relevant legislation is being observed	Minimum, Bill of costs	Contractor; FRD; Supervision engineer
Staff safety	Protection equipment, on-site work organisation	Construction site and camps for workers	Inspection and comparison with Contractor's statement about method	Unannounced inspections during construction works and upon complaints	Not available	Supervision engineer, FRD

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9 CONCLUSION

In the framework of the draft of this Environmental Impact Study, the planned project has been analyzed, wider and narrow location and area of the impact of the project through the relation of the project with the document of the physical planning, as well as other documents which are related to the considered area. After that, the possible negative and positive impacts have been evaluated which would occur with the construction of the high speed road, as well as the measures with which the negative impacts can be prevented, i.e. mitigated.

On the basis of the analysis, it can be concluded that the planned project may possibly come into in the collision with the protected natural area, i.e. the canyon of Ujća River, which is protected from the stretch of restaurant Jelen to the location Mimoza. Aiming at prevention of negative impacts, during design of this installation it is necessary to take care that the span of bearings is such that it does not endanger the river bed and banks, and that bearings of the structure are at as high canyon elevations as possible. Also, in accordance with the plans for the Physical Plan of Tuzla Canton, it is necessary to consider the possibility of construction of bypass Kladanj, i.e. displacement of main road from the settlement.

10 LIST OF ANNEXES

Annex 1. Opinions of the interested parties:

- Ministry of Physical Planning and Environment Protection of Tuzla Canton,
- PC Institute for Protection and Use of Cultural, Historical and Natural Heritage of Tuzla,
- Public Company of Forest Commercial Organization of Zenica-Doboj Canton, Commercial Unit of Forestry Olovo,
- Public Communal Company Bioštica Olovo,
- Cantonal Institute for Urbanism and Physical Planning of Zenica,
- Association of citizens of Hunting "Sokolina" Kladanj
- Sport Fishing Association "Drinjača" Kladanj,

Annex 2. View of the designed section of the road