BOSNIA AND HERZEGOVINA
FEDERATION OF BOSNIA AND HERZEGOVINA
Ministry of Transport and Communication
Federal Roads Directorate

SARAJEVO BYPASS

Environmental Impact Assessment Study

EXECUTIVE SUMMARY

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TABLE OF CONTENTS

EXECUTIVE SUMMARY

1 PROJECT BACKGROUND AND RATIONALE

This document summarises the environmental impact assessment carried out for the Sarajevo Bypass road scheme which the Federal Roads Directorate (FRD) on behalf of the Ministry of Transport and Communications of the Federation of Bosnia and Herzegovina, is planning to construct.

The Sarajevo bypass has been planned for many years. A first stage road construction was halted by the outbreak of the war in 1992. From this first stage some engineering structures still exist at the starting section of the bypass. Planning activities for the project were restarted in 2002 when the FRD commissioned Feasibility and Environmental studies. Task of the present day planning activities was, based on the review of pre-war plans, to identify the optimal solution for the realisation of the project from technical, economic and environmental perspective. It is estimated that overall for the preparatory works which include detailed design, and for construction 5 years would be needed and the Project could be opened by 2009.

The objective of the Project is to eliminate a major traffic bottleneck and to improve access on the European Transport Corridor Vc from Budapest via Sarajevo to Ploče on the Adriatic coast passing through Bosnia and Herzegovina. When completed the bypass will be part of the future motorway passing through Bosnia. Presently, the main road M-17 (E-73), between Zenica in the north and Mostar in the south, passes through the suburban areas on the west side of Sarajevo. It carries both transit traffic and local traffic, and part of it forms the main exit route from Sarajevo to the south-west of the country. This combination of traffic currently causes severe congestion on the M-17, increasing journey times significantly. At present, traffic loads on the periphery of the existing road link are 19,000 vehicles per day (annual average –AADT), which increase to 31,000 on the section Briješće –Stup and reach up to 46,000 AADT on the suburban highway west of Stup Interchange. Constructing a bypass scheme to relieve these sections within the city area is expected to bring a number of benefits. Relieving congestion would result in a better urban environment. Journey times would be reduced for both transit traffic and for vehicles entering and leaving Sarajevo.

2 PROJECT DESCRIPTION

The Project comprises a bypass scheme which consists of the approximately 10 km long bypass and a link road approximately 4.5 km in length which connects the bypass with the city of Sarajevo. The project area is located to the north-west and west of the city. About half of the length of the Bypass Road and the complete Link Road to the City are located on the north-western edge of the *Sarajevsko Polje* which is formed by the floodplain of the Bosna River and its tributaries. Here the bypass and link road are running on an embankment. The eastern and western parts of the bypass sections will run through hilly, partly wooded terrain which requires several large engineering structures such as tunnels, bridges and viaducts.

The bypass starts at Jošanica in the northeast. Up to there the M17 has recently been upgraded to 4-lane motorway standard from Podlugovici in the North. The 4-lane bypass (dual carriageway) is directed towards southwest and passes via Butila

Interchange which connects with link road, and continues via Vlakovo to the Mostar crossroads at Blažuj-Raskršće in the southwest where the present junction will be replaced by a new roundabout. The bypass road west of the link road interchange up to Vlakovo is constructed as 2 lane in a first stage with the option for extension to 4 lanes in the future. The remainder of the western bypass section from Vlakovo to the Mostar crossroads is constructed as a 2 lane road only. The 4-lane link road connects with the city road network of Sarajevo via Briješće Interchange. There connection is established with the Briješće – Stup road (M5), and further on a tie in with Safeta Zaike Street in direction of the railway station and the city. After tie in the Safeta Zaike street is widened to 4 lanes on a short stretch to the east and on the Briješće – Stup connector two lanes are added.

The Project is designed according to the Trans-European North-South Motorway (TEM) Standards. Design speed of the bypass and link road is 100 km/h, except for the section from Vlakovo to Mostar crossroads where design speed is 80 km/h. Design speed for the interchanges and connections to the existing road network is 50 km/h. The width of the 4-lane dual carriage way sections is 25 metres and the width of the 2-lane sections is 10.5 metres.

For the foreseen year of opening, i.e. 2009 the predicted traffic loads on the bypass scheme are as follows: The east branch of the Bypass is predicted to have about 16,100 AADT with heavy vehicles (HV) share of 13 % and the west branch about 12,000 AADT (HV 24%) while the city link road is predicted to have traffic in the order of 23,000 AADT (HV 16%). Operation of the Bypass scheme will in general relieve the presently congested situation on the existing route linking Josanica to Blažuj-Raskršće via Briješće - Stup. Considering anticipated growth rates, from the opening of the scheme in 2009 an overall traffic increase 70% (growth scenario average) would occur until 2025.

3 PROJECT ALTERNATIVES CONSIDERED

For the project, various alternatives and options have been studied as part of the review of the pre-war plans in the Feasibility Study. The no action scenario/Zero alternative would not change the present unsatisfactory congestion situation which in the contrary would worsen over time with increase of both local and transit traffic. In addition, a gap in the future E73 express motorway being part of the TransEuropean Corridor Vc would exist. Also the improvement of the existing roads was found not a sensible alternative, as these are passing through partly residential areas and suburbs of Sarajevo including pedestrians and slow traffic. Increased transit traffic in the future would increase overall conflicts of mixed traffic and accident risk, and also increase of noise levels and air pollution along the existing roads. Also physical constraints to the addition of new lanes exist. The improvement of the existing road network would not be compatible with the concept of a continuous motorway along the Vc Corridor. Finally, a scheme without a link road was not found feasible by the traffic modelling as an essential release route for city bound traffic would be missing in the scheme.

Alignments for the bypass road and the city link road are in general constrained by the topography and the layout of the city and its suburbs, and both the bypass and link road are included in the Spatial Plan for Sarajevo and the Physical Plan for the Kanton and the City. For the central part of the Bypass road between Reljevo and Butila the alignment as planned before the war which includes the cut–off of a

Bosna meander sling near Reljevo alternatives were investigated to avoid the impact on the river with unfavourable hydrological effects and significant alterations and losses of riparian woodland habitats. A southern alignment was developed where the Butila interchange is located south of the Bosna River between the Sarajevo sewage treatment plant and the Rajlovac industrial area, and a solution staying on the pre-war alignment including 2 additional bridges across the meander sling without the need for river regulation was investigated. The original pre-war alignment with 2 additional Bosna river bridges preserving the meander was found preferable. It keeps the alignment in the original localisation and by this does not conflict with the Urban Plan, and adverse hydrological and ecological impacts caused by a meander cut off are avoided.

4 THE EXISTING ENVIRONMENT

Relief and Landscape: The Project area is located in the central Bosnian Hill-lands along the northern edge of the Sarajevsko Polje and the adjacent hills. Sarajevsko Polje is situated in a depression between high mountains such as Bjelašnica and Igman in the southwest, and mountains of low and middle altitude in the north and northeast. Average altitude above sea level of the Polje is about 500 m.

Geology and Soils: The hills along the northern and western edge of the Sarajevsko Polje are mostly comprised of limestone, dolomites and Triassic sediments as well as freshwater sediments from the Tertiary in the higher parts. The lower parts are built of Tertiary sediments with Quarternary terraces. The floodplain area of Sarajevsko Polje is formed by the meanders and alluvial plains of Bosna River and its tributaries with up to three terraces built of gravel and sand in the eastern part of the project area. The Sarajevsko Polje area is widely covered with alluvial limestone soils which are under agricultural use and a variety of wetland soils. Soils with agricultural bonity class II are present along the link road and on the bypass alignment between Dobrosevici and Butila. Class III bonity soils are found along the foot of the hills. The hill slopes in the project area are predominantly covered with brown mineral limestone soils and pod sols and are stocked with forests or grasslands.

Climate: The region of Sarajevo and its vicinity is characterized by a moderate continental mountain climate with hot summers and cold winters. In areas of high elevation summer is cooler and shorter whereas winter is severe. Average annual temperature for Sarajevsko Polje is +9.2°C with long term monthly average minimum of -2°C in January and maximum of +18.9°C in August. The prevailing wind direction is from northwest (21 %) and calms are very abundant (59%). Average annual precipitation amounts to 938 mm and is rather evenly distributed over the year. On annual average snowfall occurs on 41 days and foggy weather prevails on average 87 days.

Ambient Air Quality: In the past for Sarajevo area the most significant contributor to air pollution was the industrial sector. Due to destructions during the war, pollution from this sources is significantly reduced. Heating of households by combustion processes has been upgraded during the last years by increased usage of low emission fuels (natural gas) and updated equipment. The increase of road traffic makes vehicle emissions a main relevant sources for air pollution at present. The large fleet of used cars imported after the war adds to this factor. Available air quality data show that no Cantonal or EC standard for annual averages was

exceeded in the Sarajevo area, however short term limit values for SO_2, NO_2, and PM10 were exceeded in the City. For the project area (except for the Briješće area and Mostar crossroads) in general low rural background air pollution levels can be expected.

Surface Water and Hydrology: The main watercourse in the project area is the Bosna River which originates from a karstic spring at the foot of Mount Igman, southwest of Sarajevsko Polje. The Bosna River collects water from several tributaries and runs in meanders through the floodplain to the northeast. A the long-term average discharge is about 30 m^3/sec. During high discharge the Bosna and tributaries overflow their banks and flooding is frequently observed in winter, spring and late autumn. Besides the rivers and streams also two groundwater-fed ponds are situated close to Bosna River at the location Butila interchange. No data of water quality of the rivers in the study area were available. Since the rivers and creeks origin from the surrounding mountain area with little industrial pollution , the quality is in general good. Due to war damages the Sarajevo sewage treatment plant which is located about 500 metres upstream from the confluence of the Miliacka with the Bosna is not operational. High organic pollution loads visibly deteriorate the water quality downstream.

Groundwater Resources: Sarajevsko Polje comprises two main aquifers which are hydraulically connected. Up to a depth of up to 30 m the sediments mainly consists of alluvial gravel layers of various grain size. This upper aquifer has a good hydraulic connection to Bosna River and its tributaries. Below up to a depth of 100 m mainly sands and clay layers are found. The permeability of the alluvial deposits of Sarajevsko Polje is high. In the study area no groundwater protection zones are located.

Flora and Fauna: The Sarajevsko Polje is among the only three remaining areas with natural floodplain features in Bosnia and Herzegovina. In the middle of the project area the floodplain vegetation along the Bosna River comprises a mosaic of natural riparian wet woodland, regular flooded meadows, ponds and vegetation communities which are typical for a natural floodplains. Among those, vegetation communities occur which can be considered rare and valuable in Bosnia and Herzegovina and are also considered of high conservation significance in the EU. Parts of Oštrik hill at the start of the bypass is covered with a thermophilic maple forest which is considered endemic for Bosnia. No areas designated for nature or species conservation exist in the project area. The central and western Polje area has resting functions for migratory birds crossing central Bosnia during spring and autumn migrations. Information on other fauna was limited. Due to the multitude of small structured wetland habitat of the floodplain area a high abundance of amphibians can be expected. The investigation area is subject to high settlement pressure and scattered settlements are developed on the hillsides. Therefore the presence of large deer populations is considered low.

Land-Use and Socio-Economic Conditions: The Project is entirely located in Sarajevo Kanton and is concerning four municipalities: Vogošća, Novi Grad, Ilidža and Hadžići. The alignment of the bypass traverses mainly rural areas and passes by a number of smaller villages and scattered settlements which are located along the north-western edge of Sarajevsko Polje and the adjacent hill lands. The link road passes open agricultural land and enters into the suburban, mainly mixed commercial/industrial and residential dominated fringe of Sarajevo at Briješće

Interchange. In the project area the most important sectors in the period before the war were agriculture and industry. After the war, ethnic structure and social conditions have significantly changed. Today, almost two thirds of the population is unemployed due to the collapse of the industrial sector. The village population in the project area often work on privately owned land on small allotments for self supply. Only in Vlakovo area several smaller industrial facilities are located along the local road where some hundred people from surrounding villages and the wider area are working.

Cultural Heritage: Several objects, cultural sites of note and listed buildings are located in the project area. These include sites from Roman and medieval times, and a number of necropolis locations, also some war memorial monuments and other historical features.

Landscape and Scenery: The landscape setting of the open floodplain with meandering regularly flooded water courses, tree- lined river banks and wetlands, and hills with scattered villages, partly wooded or covered with meadows, rising from the edge of the Sarajevsko Polje is dominating the landscape character from many viewpoints. The natural landscape character has been already significantly changed due to spreading of settlements, and various infrastructure including transportation network. In particular the eastern part of the project area the landscape is characterised by large scale infrastructure south of the Bosna and east of the Miljacka towards Rajlovac and Briješće, and also the Vlakovo to Mostar crossroads section is a mix of commercial activities and settlements. The area in Treševine hills with views into the Polje is an area used weekend houses. In the project area no landscape conservation areas and no historical and cultural monuments with prominent landscape significance are found.

5 ENVIRONMENTAL IMPACTS AND MITIGATION

The Project has the potential to cause adverse environmental impacts as a result of its physical structures; construction activities; and the operation of the bypass scheme. The primary environmental impacts associated with the project are related to traffic noise, emissions of air pollutants, road run-off water, changes in landuse and impact on properties including houses, impact on floodplain and land drainage, loss of habitats and habitat functions and landscape infringement.

Due to terrain conditions and the number of structures planned, construction activities including generation of construction material are considered a significant impact factor. Works will be carried out using conventional construction techniques based upon equipment intensive methods. There will be local construction space requirements for each major engineering structure such as the tunnels, bridges and viaducts, whereas the embankments can be largely constructed without additional space requirements outside their perimeter required for the final structure. At present planning stage no detailed concept for construction and for approach and access routes to the construction sites from the public road system is available. As a general mitigation, transportation of materials should use the alignment of the bypass and link road itself as much as possible. A first rough estimate based on an indicative overall bill of quantities shows that construction related traffic will be significant. It involves est. 36,000 truck trips for 220,000 m³ of rock fill along public roads from a quarry, est. 98,000 truck trips 4 km or less along haul routes for

588,000 m³ of material excavated in borrow pits close to site; and est. 34,000 truck trips over short distance (500 metres) for 207,000 m³ of material excavated on site.

Noise

The noise generated by vehicle traffic on the new road will affect the settlements located alongside the planned bypass and link road. Without any noise abatement measures noise levels would be significantly above the limit values (60 dB(A) day / 50 dB(A) night for the rural villages and suburban settlements) in particular at night–time in all settlements along the new road. Main reasons for this are the proximity of the new road to the settlements and the relatively high gradient above surrounding terrain on embankment sections. In total, on a length of about 7 km noise walls are necessary for the project with wall heights of mostly 2 to 3 meters height. On few locations single houses need to be additionally protected by installation of noise insulation windows to bring down the noise impact. The noise walls will also shield off light from vehicles at night from houses nearby the road.

For the existing road link from Jošanica to the Mostar crossroads (except Briješće and Stup) a slight noise reduction effect of minus 2.5 dB(A) can be expected on the section between Jošanica and Rajlovac, on the other sections reduction effects will be less.

As no details on the construction concept are available at present stage, predictions on construction related noise and vibration emissions and possible impacts on communities could not be made. As general mitigation requirement, contractors will be required to use modern noise silenced equipment (EC/2000/14 compliant) and to keep activities to usual daytime work hours. Especially in the direct vicinity of residential areas operation of noisy equipment should be limited as far as possible and noise shielding be provided.

Impact on Air Quality and Climate

With the opening of the Bypass, despite the significant growth of traffic load expected from 2002 to 2009, emission of air pollutants for the bypass scheme will decrease by about 20% for NOx and soot, 50% for CO, and SO_2, and 90% for benzene compared to the emissions on the existing road link in 2002, due to improvement in traffic flow, and anticipated renewal of car fleet and advances of engine technology of new cars. For dust (PM10), emissions will be doubled due to the higher speed on the bypass. The emission of lead will cease due to legally foreseen phasing out of leaded gasoline. On the existing road link the emissions on will decrease compared to 2002 by about 30% for PM10, 65% for NOx and soot, 75% for CO and SO_2, and 95% for benzene. This will be beneficial for pedestrians and residents living close to those roads.

Regarding ambient air impact from traffic on the new road it anticipated that all applicable long-term standards are met in the vicinity. At the mouths of the tunnels nitrogen oxides concentrations could reach or exceed short term limit values in the direct vicinity. This is in particular relevant for the settlement in the relatively narrow Rečica valley between Oštrik and Ožege. As the bridge across the valley will require noise walls to protect the residential houses these structures will support uplift of air and thus improve dispersion of pollutants. This additional positive effect of noise walls will also be beneficial on other settlement locations along the alignments. Also the planned green planting along the road will reduce air pollutant

concentration due to its filtering effect. During no wind periods on some sections the relevant short-term standards for particulate matter (PM10) could be exceeded within a narrow strip of max. 15 m alongside the road. However, where buildings are located, these will be shielded by noise walls which also minimise pollutant impact. It is recommended that air quality is monitored at buildings directly adjacent to the road, in particular Blažuj roundabout and on the west side of Briješće interchange and at the tunnels.

During construction nuisances like dust clouds from construction can be mitigated by good site management practices like water spraying.

In periods with no or only slow flowing wind streams on the regional scale (i.e. inversion), the embankment (including noise walls on top) create a barrier to local air flow. Cold air during the night slowly flows to the hill foot and is hindered by the embankment, thus creating 'cold air lake' between hills and embankment. It is anticipated that the various bridges, underpasses and culverts in the embankments will allow the air to flow-off with some delay.

Regarding emission of climate relevant CO_2, no significant differences with or without bypass scheme are expected.

Surface Water Impacts

No major relocation of permanent water courses is foreseen. On several locations the new road is coming close to the Bosna river. Care has to be taken during detailed design, that solution are planned which do not reduce the river cross section as this adversely would alter flow and erosion behaviour. The central alignment of the bypass, the Butila Interchange and the main part of the link road are located within the flood prone areas. The embankment structures will create a barrier against free dispersion and recession of floodwaters. This will be mitigated by the construction of a series of culverts in the embankment along the alignment in the floodplain.

The two ponds located at the site of the planned Butila Interchange will be affected. Depending on solutions developed in detailed design one pond can possibly be preserved.

In order to minimise impacts on the river and banks, the foundation works for the bridge abutments, retaining walls and other structures at or close to surface water bodies should be carried out during lean water season months which are usually in Summer during months July through September. During construction care must be taken to avoid any pollution by oils and lubricants or other water endangering substances of ground and surface waters. Lubricants and casing oils should be biodegradable. It is essential that proper site management is in place. The maintenance, filling up, and cleaning of construction machines should be carried out on safe locations distant from surface waters.

In order to catch the polluted water leaving the motorway (oil, tyre abrasion, solid particles, and salt in winter) and prevent it from polluting the watercourses, settlement basins, sand filters and oil interceptors need to be implemented in addition to the road drainage system. Discharge of clarified run-off will be into watercourses only where no public sewer can be reached. Collection ponds for runoff are also possible elements of the drainage system (provided filters are in place, and regularly maintained) and provide new habitats for wildlife (e.g.

amphibian habitats). For cases of accidents, an emergency plan should be established to respond to quickly deal with threats from surface water pollution.

Groundwater Impacts

No significant impact on groundwater recharge is anticipated due to the relatively small actual road surface (roughly 250 hectares) compared to the project area. Also it is not anticipated that the structures constructed for the project will have an overall permanent adverse effect on the groundwater flow, i.e. no barrier or diversion effects are anticipated. In contrast to the bored tunnels which are sealed while tunnelling progresses, the cut and fill tunnel in Treševine and the slope cut sections can temporary lead to cutting and draining of groundwater bearing strata. Construction methods should be selected such that the impact on groundwater is minimised. Detailed hydro-geological investigations will be needed in the detailed design stage, to estimate probable groundwater drainage from the slope cuttings and the possibility of cutting into the shallow aquifer. The construction of engineering structures may require the temporary lowering of the groundwater table in areas with high groundwater table. The selected construction method has great influence on the need for dewatering. Bored or driven piles for foundation require only limited pumping compared to excavated methods. Where for certain construction activities the groundwater table must be lowered a specific assessment is required.

During the construction phase special care should be taken regarding hazardous and water endangering substances used. The proper storage and handling of petrol, diesel, lubricants and paints must be ensured. Waste materials must be properly disposed. When working close to the groundwater table care should be taken to avoid spillage of water endangering substances and immediate clean-up action is to be taken in the event of an accidental spill. More serious compared to regular operation are accidents where water endangering or hazardous materials is released, at worst case accidents with road tankers. An action plan should be set up to deal with consequences of road accidents.

Impacts on Soils and Slope Erosion

Soils are primarily affected by cut and fill operations. As a good construction practise it is recommended that construction and working sites be limited as much as possible to reduce the loss of soil during construction and to re-use the top soils as far as possible involving appropriate handling and storage methods to prevent deterioration of soils. After the finalisation of the earth work protection measures must be applied which involves the use of grass turf and erosion control blankets of organic material. The construction and working sites must be limited and soils in the vicinity must be protected against soil compaction by heavy machines, the detailed design consultant should take special care not to designate areas with soils which are sensitive for compaction for work areas for heavy machinery including transport or storage. Laying out of geo-textiles on all areas which are temporarily used for construction space or transport purposes outside the perimeter of the final road bodies is recommended.

Main impact areas prone to erosion and potential earth slides due to the presence of cuts and slopes are the areas in Treševine hills and adequate mitigation measures to prevent erosion on cuts and slopes will be required.

Impacts on Flora & Fauna

The project alignment is not in conflict with nature reserves or protected areas. On some project sections loss of vegetation communities with ecological value and conservation significance occurs. This comprises well structured natural and secondary wetland mosaics in Bosna river floodplain and riparian forests along the river. In Treševine hills approx. 3.5 hectares of mixed deciduous forest partly affecting good stands of old growth with mixed beech, oak and hornbeam forest will be cut.

The new road will affect the migration of animals (e.g. birds, amphibians, reptiles and flying insects) significantly. It is anticipated that due to traffic disturbance and collision mortality the area around the Bosna river between Reljevo and Butila will be largely devaluated as bird habitat. The floodplain areas around the confluence of the Bosna and Miljacka rivers and in the western Butila fields will possibly degrade in their function as temporary resting area for spring and autumn migration.

The bypass and link road will be fenced for traffic safety reasons. This constitutes a barrier for passage of large animals. However no reliable information about the occurrence of large animals like deer was available. Landscape, terrain and habitat structures indicate that some deer crossing may be expected along the alignments. In the floodplain sections flood culverts and underpasses for agricultural access can be used by the animals. In Treševine hills the installation of animal underpasses for deer and other animals is recommended to avoid habitat fragmentation.

To mitigate impacts and to compensate for losses or deterioration of vegetation communities and habitat functions a number of measures need to be realised. It is important for successful implementation, that the detailed design consultant includes these measures in the design specifications and a competent landscape planner is involved at that stage. Main compensation measures include the ecological improvement of floodplain areas which will no longer be reasonable farmable after construction of the bypass and planting of trees and hedges.

Bird collision risk can be minimised by planting of high rows of trees along the alignment. It takes about 15 years until substantial size of trees can be expected. To mitigate some of the anticipated disturbance effects to the resting area function of the central and western floodplain area extensive planting including continuous rows of trees will be necessary specifically along the southern embankment between Butila and entry into Treševine hills, and on the link road north of the sewage treatment plant. Trees should be local species preferably with large crown habitus.

It is recommended that afforestation should be foreseen at a ratio of 1 : 3 and preferably take place in the same regional natural landscape context and only in areas which have been identified by the forest authorities. To avoid losses of amphibia a number of especially designed amphibia culverts incl. guidance elements at the base of the road embankments need to be installed. It is recommended that in detailed design stage, during the spawning season (in spring), short field inspection will be carried out by local biologists to identify the migration routes in detail and based thereon to define the exact location of amphibian culverts and guidance walls.

Construction activities have a high impact potential on flora and fauna. To avoid unnecessary additional losses the construction site should be limited to the

minimum area needed for the road works and materials should be handled within the construction site. Removed vegetation at the construction site and local borrow areas should be replanted after finalisation of the road works. For run-off from construction sites settlement basins, sand filters and oil interceptors must be provided to protect aquatic environments. The removal of shrubs and trees should be done outside the bird's breeding period and particular noisy activities like piling should not be undertaken in the floodplain section during bird migration. The intensive presence of workers in else relatively quiet areas is a major disturbance factor which is more severe than vehicles or machinery. Therefore the construction strip should be fenced off towards the Polje area which has an importance as resting area for migrating birds and breeding area for open space species.

Impacts on Landuse

Direct land use conflicts from the alignment of the bypass, the link road and the interchanges occur in the form of land consumption and loss of agricultural land and forest, and parts of village areas. Based on the information available at this planning stage it was estimated that in total about 15 – 20 residential houses along the alignments and some additional buildings (including commercial/ small industry facilities) will have to be demolished. In the section from Vlakovo to Rogačići the alignment is in conflict with several areas presently occupied by small industry. Also this is the case for the link road at Briješće interchange and at the tie in with Safeta Zaike street. In all cases further clarification is necessary during the detailed design stage when the exact footprint of the road structures will be determined and detailed topographic survey will be undertaken. Expropriation and financial compensation must be in accordance with the legal regulations of BiH/FBiH and be based on a detailed inventory of ownership form, property assets and other values affected (total or partial loss, permanent use restriction or temporary impairment or use restriction) by the road and by potential construction impacts. Due to the poor economic post-war conditions in the project area, the loss of agricultural small holdings and allotments might impact on self supply situation for affected individuals or families and requires attention.

The alignment of the bypass is crossing traditional lines of communication of the settlements Rečica, Reljevo, Butila and Vlakovo. Also the link road is crossing some important roadways such as the access to the Sarajevo sewage treatment plant, and access to Bačići village. In general established road communication are preserved by provision of underpasses, and also some relocation of local road sections with short detours will be required. This can increase travel time and distances for local movement, particularly affecting access by foot, bicycle, and other non-motorized transport. A significant deviation of local traffic is planned at Relievo where the bridge is closed for motorised traffic which will have to run via a new bridge both across the Bosna and the motorway. The alignment is located between the villages and their agricultural areas in the Polje and accessibility is altered. During public Scoping meetings (March 2004) the need for detailed planning consideration for local village communication at the start of the bypass at Krivoglavci, access to agricultural areas and re-arrangement of pathways in general and in the Polje area in particular, provision of flood safe Butila to Doglodi road passing under or over the bypass, local communication at Rogačići and the Mostar cross roads including pedestrian issues and a nearby school were identified.

Construction activities are likely to cause hindrance of local traffic routes throughout the project area. This may cause temporary delays for road users including public transport. Also some traffic disturbance for visitors of large cemetery near Vlakovo may arise. Construction schedules, transportation routes and times must be coordinated with cantonal and local authorities, public transport utilities (incl. railways) and traffic police.

According to information available, the alignment is not in conflict with places of worship such as mosques and churches or active graveyards (some historic necropolis may be affected).

Landscape Infringement

The project will significantly change the landscape as almost for the complete length of the alignment the road is not at grade with the present terrain level. In particular the almost uninterrupted and significantly high embankment of the bypass which is traversing the floodplain will be visible from many directions. This also applies to the Butila interchange where the link road meets the bypass. The required noise protection walls of 2 – 4 metres will significantly add to the visual impact. Along the rural villages traditional views to the river landscape and the fields will be disrupted by the view barrier of the road embankment and noise walls. Also viaducts, bridges will significantly mark the alignment in the landscape.

Landscape impacts can be mitigated to some extent by green shielding of structures and architectural design to integrate structures into the surrounding environment. Exposed surfaces shall be re-vegetated as soon as possible. Planting of with trees and shrubs on embankments, and additional vegetative screens composed of bushes and trees where noise walls are visible from the villages is proposed. Only species typical for the region should be used for planting. It is recommended that transparent noise walls on the viaduct across the Rečica valley and Vlakovo viaduct are installed to reduce visual barrier effects.

Archaeology, Cultural & Historic Heritage

Based on available information only a few locations with objects of possibly archaeological or cultural interest might be affected by the alignment. The classification of the object importance and instruction for possibly required protection measures should be provided by the relevant authority to be included in the final design stage. At the construction stage experts from relevant institute should be involved in construction supervision. As other objects may be found during earth works, the contractors will be required to notify immediately any other findings to the relevant authority.

6 ENVIRONMENTAL MANAGEMENT

The environmental management section contained in the EIS main report details as far as possible at the present stage of planning the mitigation, monitoring measures and institutional responsibilities to be taken during project implementation. This includes subsequent planning activities (detailed design and associated activities), construction and operation. It will be the task of the detailed design consultant and the contractors appointed at a later stage of the project to further detail the issues addressed according the increasing level of planning detail in each stage. It is advised that the environmental issues addressed in the EIS Report to be made

available to the detailed design consultant for further consideration in the planning process and detailing of the specifications of the tender documents for the construction contractor(s). In addition any requirements which arise as part of the permitting process, in particular obligations imposed by the permit will need to be included in the planning documents to be set-up by the detailed design consultant. The detailed design provisions for environmental protection and mitigation have to be approved by FRD's Environmental Unit before commencing work and shall be agreed with the competent authorities.

The construction contractor(s) will be contractually bound to follow a good management and environmental practices during all construction work activities and to keep damage to vegetation, soil, groundwater, surface water, landscape as well as disturbance to settlements and local communication to a minimum. Environmental requirements will be binding part of the contract conditions of the contractors. It is recommended that contractors(s) are required to implement an integrated Health & Safety and Environmental Management System which is in accordance with EN ISO 14001. A Health & Safety and Environmental Coordinator should be designated to ensure compliance with legislation and targets of the Management System.

To ensure the effective implementation of the EMP the Federal Roads Directorate will commission an Environmental Inspector to undertake a program of environmental supervision and monitoring during the construction. His key responsibility will be to ensure that the environmental management measures, controls, and specifications are properly implemented as per the terms and conditions of the approvals and permits.

Environmental management during operation of the bypass in general will comprise the monitoring of efficiency of the measures implemented in the road design and monitoring of operational emissions and effluents from road traffic. Operation monitoring and management will be organised by the environmental unit of the FRD. Certain tasks or monitoring campaigns may be contracted out to specialists and should at minimum include traffic surveys, noise and air pollution monitoring, wastewater and storm water runoff monitoring and maintenance of drainage and purification systems, vegetation maintenance, monitoring of animal passage and road safety.