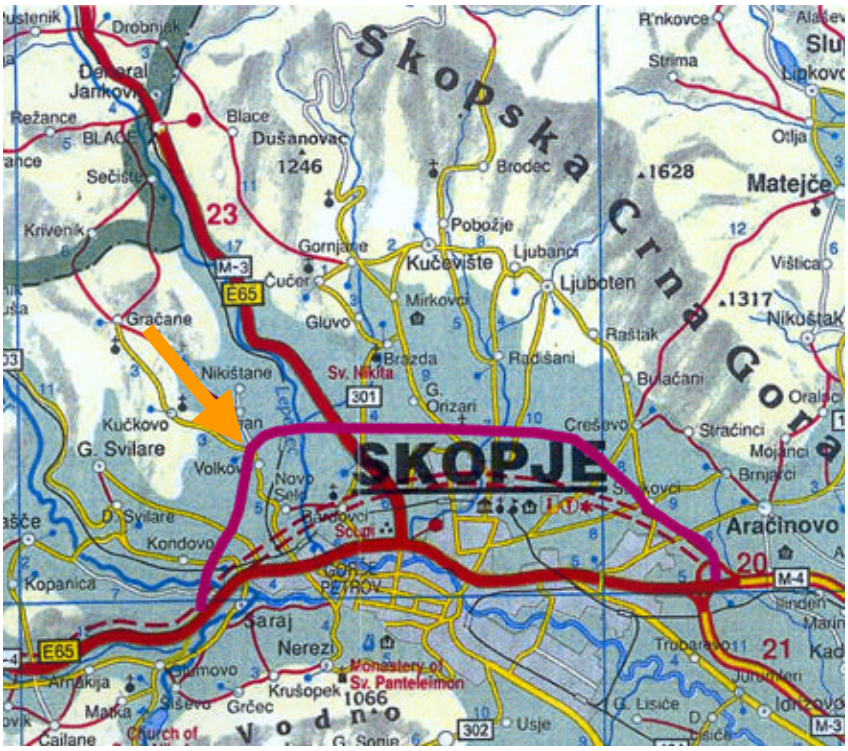
EXECUTIVE SUMMARY

FUND FOR NATIONAL AND REGIONAL ROADS
FYR OF MACEDONIA

EUROPEAN BANK FOR RECONSTRUCTION
AND DEVELOPMENT EBRD

MACEDONIA REGIONAL ROADS PROJECT
SKOPJE BYPASS, UPDATED FEASIBILITY STUDY
ENVIRONMENTAL IMPACT ASSESSMENT STUDY



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EXECUTIVE SUMMARY

The *Fund for National and Regional Roads of Macedonia* (FNRR) is planning to construct a bypass for the capital Skopje consisting of a four lane highway. ERM Lahmeyer International was commissioned by FNRR to conduct an Updated Feasibility Study for the Western part of the road (Stage 2). The study is financed by the *European Bank for Reconstruction and Development EBRD, London*.

The Updated Feasibility Study comprises Traffic Data Compilation and Analysis, a Cost Estimate and Economic Analysis and an Environmental Impact Assessment (EIA). The Executive Summary on hand, outlines the results of the EIA.

An EIA-Study for the entire Skopje Bypass was conducted by *ERM Lahmeyer* in 1999/2000. Based on the study, the FNRR decided to move the Western part of the alignment northwards. This new alignment is part of the investigation of the present study.

In Macedonia, an EIA law is presently under preparation (status December 2001). The EIA considers a single alignment as presented by the Technical Planner and the no-project alternative. Difficulties compiling the information result from the poor database. Field investigations were conducted to the extent possible to overcome these constraints. The tense political situation prevailing in Macedonia at the time of field investigation (autumn-winter 2001) had some influence on the site access (e.g. one area for depot of excess soils could not be visited).

A Scoping Meeting for the project was held in December 2000. Representatives from the FNRR, EBRD and various NGOs participated. The results of this meeting were considered during the preparation of this study. According to the EBRD procedures the EIA must be made publicly available. The EIA will be presented and discussed in a public meeting.

Project Description

Presently, the international transit passes through Skopje where insufficient road capacities cause frequent traffic jams. The planned alignment is located North of Skopje and pass mainly through agriculturally used land. It will pass some nearby villages.

Two key Pan-European Transport corridors cross the country of Macedonia and intersect at Skopje, forming part of the Trans-European Network (Corridor VIII and Corridor X). The Skopje Bypass is part of Corridor VIII.

The complete bypass starts at the Hipodrom loop where it branches off from the Veles-Skopje highway. The bypass road section considered in the present study, is Stage 2 , which constitutes the western half of the bypass.

This western half starts North of Suto Orizari. Leading westwards, the route passes the Konjski Rid hill lying to the South and continues West crossing the Stenkovec loop (junction to Pristina), followed by the Lepenec River. Here, the road bends slightly northwards, running through the agricultural region of Gornopal, where it eventually curves to the South, passing the residential area of Vucidol. The route continues southwards winding through a hilly landscape. At Kondovo, it connects to the Skopje-Tetovo Highway.

The designed bypass will be a four lane highway with a maximum vehicle speed of 120 km/h. The settlements along the highway will have access to the bypass via an interchange. Crossing of the highway for local traffic, pedestrians and bike riders will be possible using several overpasses and underpasses.

The investigation area covers a 300 meter zone on each side of the planned alignment. Where needed, an enlargement was considered to investigate relevant features (e.g. at the Lepenec River). The investigation area for the noise prognosis covers a 700 meter zone (as a minimum), on both sides of the road.

Description of Environment

The environmental conditions in the project area can be described as follows.

Relief and Landscape

The western part of the alignment is situated in hilly terrain and limited to the South by the Vardar valley and to the East by the valley of the river Lepenec. The eastern part of the investigation area consists of two plains, the Lepenec fluvial plain to the West and the Lepenec terrace to the East, including some smooth hills.

The land use is dominated by agriculture in the eastern plain and the south-western smooth hilly area. While a monotonous scenery of crop fields prevail

in the East, more diverse fields and vineyards prevail in the South-west. The north-western hilly area, with its semi-natural vegetation structures, is a landscape with variety and beauty. Disturbance in the scenery comes from the developing housing areas of Vucidol.

Geology and Soils

According to the geology/geomorphology different units can be distinguished. The oldest geological formations along the planned road alignment are presented by Cretaceous Rock and Flysch sediment which can be found in the North-west. The Miocene and Pliocene sediments consisting of sand, shales and clay are present in the North and middle part of the alignment. Pliocene conglomerates are found near the village Kondovo. Quaternary sediments including Terrace and Alluvial deposits are present in the wide valleys of the rivers Vardar and Lepenec.

Alluvial soils are typical for the river plains. Groundwater influence is typically below 1.5 m. Rendzina is the typical soil type where Cretaceous Limestones occur. These thin layered soils are present on the slopes around Vucidol. The soils are typical for the biotope types, dry pastures, degraded submediterrean forest and pine afforestation in the investigation area. Different types of Cambisols occur in the remaining parts of the study area. Eutric Cambisols are present on loamy, clayey parent material and are assigned a high agricultural value. Cambisols with a more sandy or silty texture are located East of the Lepenec. Erosion is an obvious phenomena on the slope near Kondovo where highly erodible soils with silty texture are located.

Climate

The Skopje basin is exposed to winds from all directions. The Vardar valley is dominated by a wind called Vardarec, mainly a northwestern and southeastern wind direction. For the project area wind directions tending Northwest can be considered likely.

Ambient Air Quality

Data on ambient air quality was not available for the area of the new alignment. Some measurement data for nitrogen dioxide, sulphur dioxide and lead were available for the city area of Skopje. Comparison with ambient air quality standards of Macedonia and Members States of the European Community revealed that all standards were met.

Since the reported data were determined in city areas which are affected by traffic, industry, and residential heating burner air emission sources, it is assumed that the concentrations in the area of the new alignment are those found typically in areas of rural character.

Surface Water and Groundwater

Within the study area rivers, streams and channels exist. In the western hilly terrain, streams are of natural origin, whereas in the eastern plains water flows dominantly in manmade water courses. Perennial natural rivers are the Lepenec and the Vardar.

The Vardar is adversely impacted by regulation measures and sewage discharge, whereas the Lepenec flows within a naturally formed riverbed with wide gravelly fluvial plains.

The Lepenec is the source for a sophisticated irrigation system. A main irrigation channel is diverted from the Lepenec near Orman and flows along the slope of the hills to the South and further West. Secondary irrigation channels exist in the Lepenec plain. The visible water quality of these channels is good.

Within the western part of the study area, along the hills from North of Vucidol to Kondovo in the South, several temporary streams exist.

The Alluvial deposits present in the valleys of the rivers Vardar and Lepenec are considered the main aquifer in the region of the alignment. Water levels were found at approx. 2 m bgl or deeper. The thickness of the aquifer is about 10 m.

Other aquifers such as the Karst aquifers as present in the North-west of the alignment and aquifers present in the Pliocene sediments are considered of minor importance for water abstraction. Impermeable layers are presented by the Flysch zones.

Small wells for private use are common in the alluvial plains. No groundwater protection zones are known along the alignment. Spas South of Vucidol (*Kisela Voda)* are solely used for the production of carbon dioxide for industrial purposes.

Quaternary aquifers are not protected by impermeable layers and are sensitive to impacts. Karst aquifers are also sensitive to impacts due to wide open spaces and the absence of protective layers.

Flora and Fauna

The eastern part of the investigation area is agricultural with low structural diversity. Although some EU wide protected species are located in the study area, the number of plant and animal species is lower than in other areas investigated.

The biodiversity and ecological value rises towards the Lepenec plain, where the structural diversity increases and the landscape-ecological conditions support wetland-like areas. The river Lepenec, a natural biotope with riparian vegetation, is important for Flora and Fauna. Land used for agriculture takes place West of the river Lepenec. In between the fields and dispersed housing areas, irrigation channels and different vegetation structures offer wetland habitats of high value.

The high structural diversity of the hilly terrain North and West of Vucidol results in an alternation of dry pastures, shrub communities, pine afforestations and fragments of degraded Sub-Mediterranean oak forest. A plant community that is protected by the EU FFH-Directive (*Festuca-brometea)*, and shrub communities on the dry pastures are also of high value for birds and insects, especially butterflies and grasshoppers.

Further South, biodiversity declines again depending on the intensity of agriculture. Important habitats and the rare endemic Macedonian Broom species G*enista Nissana* grow on the slopes at Kondovo.

Social and Economic Issues

In the last decades strong settlement growth took place caused by the population increase. At least part of these residential areas are not covered by official permits. Different ethnic groups are living in the area. Residential segregation can be observed.

The planned alignment passes near some of the villages and residential areas; housing areas in Vucidol village will be crossed by the alignment. All other villages and residential areas in the corridor are, at least, at a 200 m distance from the alignment.

The route crosses mainly intensively used agricultural areas (partly with high structural diversity), vineyards and dry pastures. Because of the intensive use of land for agricultural purposes, industries are not found and industrial zones are not designated for development in the alignment corridor.

Cultural and Historic Features

Within the Skopje region, several archaeological locations dating from prehistoric, antique or middle age period can be expected. The *Institute for Protection of the Cultural Monuments of the City of Skopje* (IPCM) therefore requested that an archaeological reconnaissance survey of the terrain should be carried out. No cultural heritage sites or features are known to be present in the area of the alignment.

Environmental Impact Assessment

The primary environmental impacts associated with the construction of the highway are related to:

- Air emissions, water pollution and traffic noise
- Disposal of construction material
- Erosion
- Flora & Fauna; and
- Landscape infringement.

The evaluation of environmental impacts in the EIA is based on the best available information at the time the study was prepared. Appropriate mitigation or compensation measures were identified and are addressed.

Impact on Climate

Effects of the new highway on climate can influence the local wind streams and micro climate by barriers and changes of surface characteristics. Given the design of the alignment, no significant barrier is planned which could affect

the wind streams significantly. The installation of noise prevention walls, embankments, cuts, and the highway itself will only have minor effects on the local climate.

Another impact on climate is the emission of carbon dioxide (CO_2) by the combustion of fuels. In general, fuel consumption by vehicles will be reduced in the future by improvement of vehicle technologies. The shift of traffic load from downtown Skopje to the highway, with its more advantageous flow of traffic, will reduce total CO_2 emissions of this traffic by approximately 30 % (5,000 - 7,000 tons per year).

Air Pollutant Impacts

Vehicle traffic is a source of air pollutants which are emitted from the engines exhausts. Emissions and impact of relevant air pollutants (carbon monoxide, sulphur dioxide, nitrogen oxides, lead, soot, carbon hydroxides, and benzene) were calculated, taking into consideration type of vehicles, fuels and engines as well as road characteristics such as inclinations. Two scenarios were examined each considering the forecasted higher traffic figures, but different levels of engine technology (Scenario A: low profile with leaded fuel; Scenario B: modern technology).

According to the results, the amount of pollutants emitted will significantly decrease from Scenario A to Scenario B by at least 70 %.

Based on an estimation of traffic related emissions, the pollutant concentration in the neighbourhood of the alignment was calculated considering average wind speed and the planned noise protection walls.

The results show that the highest concentration will be found at the centre of the intersection Loop Stenkovec. Other high concentrations are expected within narrow bands alongside the inclining segments of the bypass. Concentration levels of the various pollutants decrease by at least 60 % from the road border to a distance of 200 m.

The concentration of the pollutants generated by the bypass traffic was discussed with respect to air quality standards specified in Macedonian, European, and German legislation. All of the applicable standards will be met by the traffic generated impact concentrations.

In addition to the traffic related impact, background concentrations from other sources should be taken into consideration for evaluation of the future ambient air quality. It is assumed that, due to the rural character of the area, the background concentrations are most likely below 50 % of the air quality

standards. The traffic related impact was, therefore, discussed with respect to a value of 50 % of the respective air quality standards. With the exception of NO_2, even the maximum calculated concentration of the pollutants discussed is below the 50 % threshold level. For NO_2, only a narrow band of 30 m maximum breadth exceeds this threshold at the segments with steep inclination and at the intersection Loop Stenkovec. No sensitive environmental factor is affected in these areas. In summary, no significantly adverse effect on the environment is to be expected from air pollutant emissions on the new alignment.

Water Pollution Impacts

During the construction phase, care must be taken to avoid any pollution by oils and lubricants of ground and surface waters. The release of these substances can have serious impacts on the water quality of both the surface and groundwater, and can severely effect aquatic fauna and flora. Driving in the river should be avoided. During construction no dams or similar facilities to provide access to the construction site should be erected.

Conflicts during the operation phase could be caused by water pollution. Oil, tyre abrasion, solid particles and salt or other de-icing agents in winter can be discharged with the surface run-off into the river. Polluted surface run-off from the bridge should be prevented from discharging into the river. The danger of water pollution due to traffic accidents is high. Therefore a high safety standard must be applied. Additionally, extra robust crash-barriers should be installed to avoid pollution of the river in case of accidents.

The crossing of the river will result at least partly in a loss of riparian vegetation. The bridge is not expected to be a migration barrier. The impact on the banks will decrease the importance of the banks as a habitat.

General impacts on the groundwater during the construction phase will be the lowering of the groundwater table if it is close to the surface. Based on the detailed design and the need for groundwater lowering, the impacts shall be assessed. The impacts will be limited in time and space.

It is anticipated, that disturbances of the hydrological regime will be limited by extension and appear predominantly during the construction phase.

In general, the impacts on surface water and groundwater by traffic-related substances is considered minor. It is assumed that construction and operating will not have any significant effect on surface water and groundwater hydrology and quality, if proper management is applied. Nevertheless, if any

temporary or permanent lowering of the groundwater table is needed or will occur, a specific assessment will be required.

Noise Impacts

The noise generated by vehicle traffic on the highway will affect the settlements located alongside the planned bypass. For evaluation of noise impact and determination of suitable noise abatement measures, calculations of noise levels were carried out. The calculated noise levels were evaluated with respect to noise standard regulations of Macedonia, the WHO and countries of the European Community. The applied noise standards for existing residential areas were 60 dB(A) at daytime and 50 dB(A) at night time. 55 dB(A) at daytime and 45 dB(A) at night time should be kept in future residential areas. Sensitive buildings, such as school houses, were discussed separately.

The results of the calculations, without any noise prevention measures reveal high impacts with outdoor levels exceeding 65 dB(A) at night time for few buildings located close to the highway Northeast of Vucidol. Residential areas in Vucidol, Kondovo and Dorce Petrov are affected by noise levels exceeding 45 dB(A) at night time. This reveals the need for implementation of noise abatement measures. Effects of various mitigation measure alternatives were calculated. Installation of noise prevention walls, i.e. 4 m height were found to be the most efficient mitigation measures. The total size of residential area impacted by noise levels exceeding the limit of 50 dB(A), can be reduced by the recommended noise prevention walls by approximately 65 %; for the 45 dB(A) limit the area size reduction will be 45 %.

By shifting the traffic from the city of Skopje to the bypass, an advantageous reduction of traffic noise in the city can be expected. Noise reduction was estimated to be up to 2 dB(A).

During the construction phase noise reduction should be considered and noise intensive works should be executed only during day time.

Impacts on Soils and Erosion

In general, soils are mainly affected through cut and fill operations. The construction will result in a sealing of natural soils of about 0.25 km^2. Operation of the Bypass will not have significant impacts on soils if proper protection measures will be applied. Special care must be taken to avoid soil and groundwater contamination by spill of hazardous substances, especially for those areas with a high water table and absence of protective layers.

Inadequate protection of cut and fill areas may result in soil erosion. The Technical Design already considers appropriate protection measures for slope stability. Further supporting measures such as retention walls or sheet piling for sensitive sections of the road alignment should be considered. Special care should be taken for construction of drainages at those cut sections where permanent water seepage appears after construction.

It is proposed to re-use the top soils as far as possible based on the best available technology. Prior to construction, the fertile top soil layer should be carefully removed. Soils adjacent to the construction sites must be protected against compaction by construction machines. After finalisation of construction works the fertile soil should be placed on the slopes. After replacement of the soils, protection measures against soil erosion are needed.

Impacts on Flora & Fauna

Eutrophication and altering of plant communities by air pollution is a mainly problem within a 10 metres buffer along the road. Soil pollution with heavy metals or organic pollutants is normally limited to the direct vicinity of the road.

No nature reserves or other protected areas are occurring in the investigation corridor.

An impact during the construction phase is the nuisance of breeding birds by the construction machines due to exhaust fumes, noise and visual irritations.

Noise, air pollution and visual irritation caused by the traffic can decrease the value of bird habitats in a radius of several 100 metres. The consequence will be a significantly decreased density of breeding birds. The birds are also endangered by traffic, especially in sections with hedges close to the road.

The four lane bypass will affect the migration of animals (e.g. birds, amphibians, reptiles and flying insects) significantly. The planned high wire fences are protecting animals against car collisions on the one side; on the

other side are also increasing the barrier effect. The barrier effect of the fences will be relatively high in areas without underpassing (animal culverts) or overpassing (greenbridge) possibilities (in the eastern area of investigation and partly in the western area). The planned illumination of the alignment has an adverse impact on night active insects because they are strongly attracted to the light. It is therefore highly recommended not to implement illumination. The migration possibilities for animals will be secured by the construction of culverts under the road body. An improvement of the living conditions of animals and plants can be achieved by the development of further habitat structures like dry pastures, hedges, submediterranean forests and wetland biotopes.

To avoid unnecessary additional loss of biotopes the construction site should be limited to the minimum area needed for the road works. The dumping of material should be handled only within the construction site. The removed biotope structures at the construction site should be restored after finalisation of the road works.

The removal of shrubs and trees should be done outside the bird s breeding period.

Landscape Infringement

During construction and due to the infrastructure itself, the landscape will be changed. Additional areas will be required for implementing the construction sites and for temporary dumping of excavated material, what declines the scenery s value.

During the construction phase significant impacts on the recreation function of the landscape may occur due to noise immission and general disturbance, e.g. the presence of construction vehicles.

The alignment through hilly terrain with its land-cuts, bridges and embankments leads to a significant change of the scenery. The slope- and deep land-cuts increase the exploitation of area. Additional areas for dumping sites of excess soil and debris masses are needed.

The visual impact of the construction should be minimised. This can be done best by means of planting.

Socio-economics

The bypass will cut off existing interconnections between the South and the North. Crossing of the highway for local traffic, pedestrians and bike riders will be possible using several overpasses and underpasses which will reduce the separating effect of the road. The construction of the new highway will not affect any known material assets in the investigation area.

Cultural & Historic Heritage

An archaeological reconnaissance survey of the terrain should be carried out according to the request of the *Institute for Protection of the Cultural Monuments of the City of Skopje* (IPCM). However, no cultural heritage sites or features are so far known to be present in the area of the alignment. The execution of the excavation works should be carried out carefully and under the constant supervision of an archaeologist.

Monitoring

It is recommended that the tender dossier includes the environmental obligations the constructor should fulfil.

The contractor should be obliged to follow a proper environmental practice during all construction work activities and to keep damage to vegetation, soil, ground water, surface water, landscape and disturbance to settlements to a minimum.

The contractor should provide proper documentation prior to the works, which will give details with respect to environmental issues (removal of vegetation, construction camps etc).

The mitigation measures which will be considered in the final design shall be outlined in an Environmental Management Plan which must be approved before commencing work.

Conclusion

Based on the results of the investigations, taking into account the proposed monitoring and mitigation measures, and compared to the impacts of the no-project alternative the environmental impacts of construction and operation of the Skopje Bypass can be considered as environmentally acceptable.