AZERBAIJAN REPUBLIC
MINISTRY OF TRANSPORT
"AZERROADSERVICE" OJC

ENVIRONMENTAL IMPACT ASSESSMENT

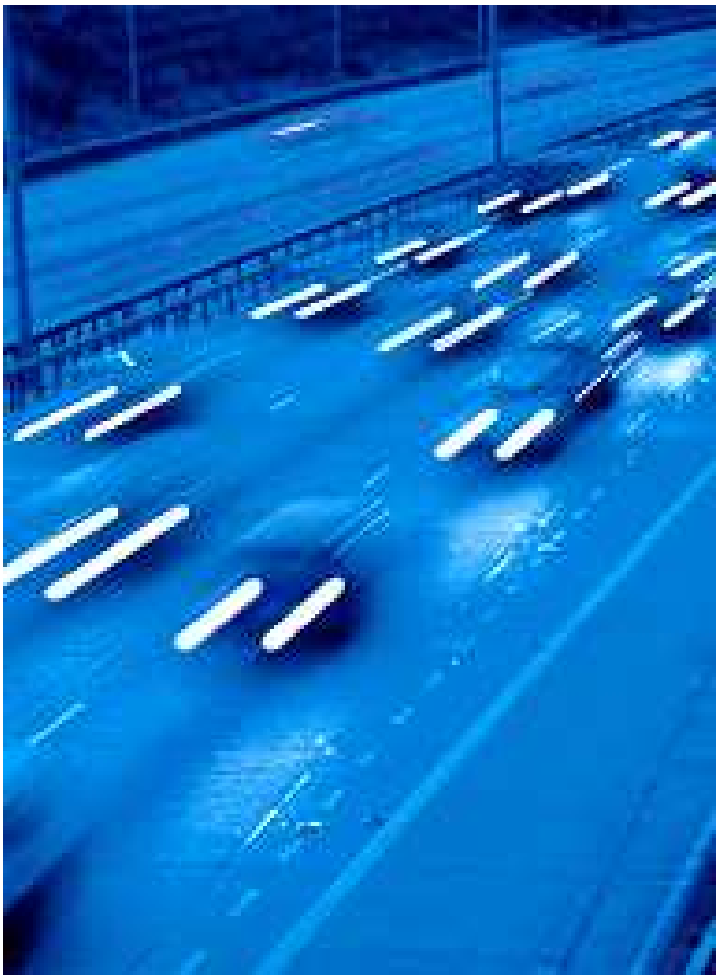
Azerbaijan Highway Project II-Additional Financing

IBRD Loan No. 7516 AZ

Upgrading of Baku-Shamakhi Road Section of Baku-Shamakhi-Yevlakh Road, preparation of Environmental Assessment and Environmental Management Plan

IRD ENGINEERING

SPT S.R.L. Studi e Pianificazione del Territorio



November 2013

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0 INTRODUCTION

0.1 Project Background and Previous Studies

The Government of Azerbaijan has received a loan/credit from International Bank for Reconstruction and Development (IBRD) and intends to apply a part of this loan for the consulting services for preparation of the Environmental Impact Assessment and Management Plan for the Baku – Shamakhi upgrade from 2 lanes to 4 lanes of the section from km 45 to km 121 (including the planned Shamakhi bypass), under Azerbaijan Highway II Project Second Additional Financing. The Project will be also co-financed by the Government of Azerbaijan.

The Government complies with the typical requirements for candidacy under Bank financing, including the formal investigations and studies to demonstrate the technical, financial, environmental and social viability of the scheme while addressing the impacts that the proposed development will have on the environment and on the people.

The M4 connects Baku with Yevlakh in central Azerbaijan, and comprises a reasonable alternative route to the M4 between Baku and Yevlakh for lighter vehicles. The Baku-Shamakhi road is a section of the shortest way from Baku to Georgia and to western Azerbaijan.

The existing road section is a two –lanes carriageway road with a paved width of 9.00 m and an unpaved shoulder width of 2 x 3.00 m. The road is presently under rehabilitation.

The topography along the Baku – Shamakhi road is characterized by undulating arid hills and mountains. The relief gradually transforms from plains in the east over to foothills and lower mountain areas of the Greater Caucasus in the western part of the study corridor. The area further to the west, around Shamakhi, is erosive-denudative mountains. On its way to Shamakhi the road crosses a number of wide river terraces and river canyons which all represent erosion types of landscape.

As well as many long, straight sections through unpopulated semi-desert areas, the road includes a number of steep, winding sections through the mountains with tight, blind corners.

Upgrading will convert the present two-lane road to four-lane dual carriageways, via carriageway widening, while bridges, cuttings, embankments and other structures will be implemented where necessary. Each lane will be 3.75 m wide and each carriageway will be provided with a 3.75 m shoulder, the central reservation being 5.00 m wide, (including safety barriers) thus achieving a total width of 27.50 m as to the completed road.

Upgrading will include also construction of grade separated interchanges. Further details of these and every other works should be obtained from the consultant of engineering design once the study is finalized.

0.2 Scope of the Present Report

The Environmental Impact Assessment report aims at a systematic identification and evaluation of the real and potential impacts of the proposed widening of the Baku- Shamakhi

project on physical, chemical, biological, cultural, social and economical components of the entire environment. The goal of EIA is to encourage the incorporation of environmental aspects in planning and decision-making process that eventually should result in more environmentally acceptable activities.

Purpose of EIA is:

- identification of the main potential impacts of the road project during construction and operation phase
- establishment of mitigation measures to reduce negative impacts and of relevant monitoring systems
- preservation of social, historical and cultural values of people and their communities in the area of influence of the study road
- the incorporation of specific mitigation measures into the final detailed design.

0.3 Report Structure

This report comprises an assessment of potential negative impacts of Baku- Shamakhi road construction and proposes adequate mitigation measures aiming at reducing the impacts on the environment. The following table summarizes the structure of the report.

Chapter 1	Project summary and the measures and recommendations proposed by the Consultant
Chapter 2	Overview of the policy and legal framework under which the present report has been prepared
Chapter 3	Short description of the proposed project with its objectives and purposes
Chapter 4	Environmental Baseline Conditions (Physical and biological environment, Historical and cultural heritage, Socio-Economic environment) and the critical areas
Chapter 5	Assessment of environmental impacts. This chapter defines an overview of both the potential impacts that may be expected to occur temporarily during the construction period of the Baku – Shamakhi Road and the permanent impacts that may accrue
Chapter 6	Brief description of the alternatives analyzed
Chapter 7	Overview of recommendations and mitigation measures during the construction and operation period
Chapter 8	Environmental Management Plan, which comprises the environmental monitoring and control, the implementation and operation, checking and corrective action and management review
Chapter 9	Monitoring plan
Chapter 10	Public Consultations
	Annexes & List of References

0.4 Description of the Project

Azerbaijan's geographical position makes it an important link between the Black and Caspian Seas and between Russia and Iran. Trade with its neighbors, both transit and bilateral, is an important feature of the Azeri Economy. Economic prospects are bright on the short and middle terms. The overall GDP is expected to increase.

Being most of the non-oil trade shipments transported by road to the neighboring countries, access to international markets requires the provision of suitable road transport infrastructure on corridors ready to safely accommodate the mid-term strong traffic increase and to replace the existing narrow, low quality roads.

Starting with the observed (counted) traffic flows in 2005 on the Baku – Shamakhi road, traffic has increased significantly replicating the GDP growth from 2005 to 2009. From the year 2010 to 2020 traffic is expected to grow by 48% and between 2020 and 2030 by 54%.

The upgrading of the entire length of Baku-Shamakhi road to four lanes is currently under evaluation of the Ministry of Transport in Azerbaijan. Currently the road consists of a first four-lane section 13.3 Km long and a following section up to km 45 which is presently being upgraded to four lanes. The whole length of the existing carriageway of the Baku to Shamakhi road is to be reconstructed under the Highway 2 Project financed by the World Bank.

For the purposes of the environmental assessment, the project has been assigned to the A environmental category (World Bank Operational Policy OP 4.01 'Environmental Assessment'). The Regional Environmental Review and Environmental Management Framework have been prepared for the whole road, and an Environmental Impact Assessment and Management Plan has been developed for the first 30 km section of the road (km 15 to 45).

The main overall Objectives of the improvement of 76 km of the Baku-Shamakhi road widening the existing road from 2 lanes to 4 lanes, are:

- to boost the national and regional economy, supporting the swap of goods with neighbour countries and creating temporary and employment opportunities;
- to further the introduction of international standards in the transport sector of Azerbaijan and thus generally support the Country in westernizing process.

1 EXECUTIVE SUMMARY

1.1 Project summary

The Baku – Shamakhi Road corridor has been divided into three road sections:

- Section 1- From km 45+000 to km 67+500
- Section 2- From km 67+500 to km 91+000
- Section 3- From km 91+000 to km 121+000

General terrain characteristics, the land use and the major junctions have been the criteria applied to distinguish the sections.

1.2 Brief description of the project area

The area of the "road development corridor" Baku-Shamakhi Road (km 45-121) under analysis is composed by three natural main sections:

1. First Section, whose initial part belongs to the Gobustan Rayon, is characterized by the absence of important villages. Rarely settlements and an agricultural sector (dry land) coupled with breeding farming can be found. In the following part, the house settlements of Dzheirankechmaz, consists of only a dozen of buildings on both side of the road.
2. In the Second Section the area a few kilometres far from Dzhangi and 2 km far from the M4, is characterized by the agricultural village of Sixazirli and in the adjacent location by one of the famous "mud volcanoes". The North side include the presence of agricultural arable and fertile land. Moreover, the Section includes the settlements system of Narimankand-Maraza, two ancient agricultural villages currently connected by an internal road and by the M4. The two villages (nowadays formally administratively joined under the name of Gobustan) show clear urban development trends. Nevertheless due to the fact that they were joined recently, it has not been possible to develop a plan to coordinate the urban development of the area and the upgrading of the highway. Therefore as a consequence of the upgrade of the road, it is recommended Technical Assistance to the Municipalities in order to make them able to afford and tackle the opportunities coming from the reorganization of these new urban settlements together with the existing and new economic service activities. In other words, to develop a set of urban planning and architectural design to coordinate the upgrading of the M4 opportunity with the development of the village. Such kind of assistance can be provided in the next years, under a different project, when the full utilization of the new road will make clear the role plaid by the new road in the development of these settlements.
3. Third Section. The last part concerns the village of Sabir, having more than 4.000 inhabitants and located along the M4 on the Pirsaat River, after less than 20 km from the previous section. Village development is more significant on the left side of the road (toward Shamakhi) while the right one is still under expansion. Although the

village of Sabir has an agricultural origin, local community has put several efforts to upgrade it to urban village. The city of Shamakhi, once the capital of the Azerbaijan and currently the centre of the viticulture and fruit culture of the Shirvan Region (Rayon) is located not far from Sabir. Shamakhi has more than 35.000 inhabitants and it is the attractor pole for all characteristic polycentric settlements scattered all around in the area.

1.3 Mitigation Measures, recommendations and conclusions

The most important measures and recommendations are mainly related to the environmental conditions of the area coupled with the technical characteristic of the road design.

The main measures refer to:

- Urban Area, crossed by the new upgraded road;
- Soil stability strengthening, being local soil prone to erosion, landslide still active but expensive bypasses construction excluded;
- Protection of some very important agricultural areas nearby Maraza, Sabir and Shamakhi;
- Safeguard of some endangered avian species normally nest during some periods of the year;
- Prevention of interferences between the groundwater and the bottom of the excavation by adoption of safety distance identified by the detailed design.

The main recommendations to be developed by the designer before the construction and to be implemented during the construction include:

- Urban Design: to develop a detailed urban design in the settlements crossed by the road. This should be performed by an experienced urban designer together and in close cooperation with the road engineer in order to mitigate the impact, to improve the wellbeing of the population and the quality of the urban areas and to implement safety measures before the start of the construction. The local communities should be kept informed and involved in the project since the very first stages;
- Construction methodologies; based on the recommendations included in this report, to adopt proper construction methodologies, especially to strengthen the slope stability (especially for the sections 2 and 3);
- Protection of agricultural soil: to avoid as much as possible the consumption of precious agricultural soil;
- Safeguard of protected birds reproduction; to prevent the disturbance during the nest period of the Falcon Lester (Falcon Naumanni); potentially significant ecological impacts during construction works on or nearby the existing bridges n.2 and n.3 over the Jeyrankechmez River. The bridges should remain untouched during the nesting season due to the local breeding colony of the globally threatened, Lesser Kestrel (*Falco naumanni*). The nesting season varies depending on atmospheric temperatures, generally from April to July. No dismantle works can be performed without the prior field investigation and approval of a national ecologist. Hunting and/or trading of this species by the work force should be prevented.
- Construction waste material disposal: to be provided together with detailed management and restoration plans for the excavated materials. This must be done by the contractor according to the guidelines established by the supervision team and should specify the

types of construction wastes and designated disposal sites agreed with the local executive and environmental authorities.

The selected alignments

The alignment has been selected based on:

- available budget for the widening of the Baku- Shamakhi Road;
- general physical and geological condition of the existing alignment;
- efforts to prevent or avoid environmental impacts on sensitive areas, if any. However there are no such areas along the designed alignment. The only sensitive area (called the sanctuary birds) is 10 km far from the road axis and therefore is not affected by the project;
- design choices;
- attention to prevent any impact on sacred places such as cemetery, mosque and holy place(Sabir and Darakand) as well as social infrastructure (schools, hospital and medical centres in Sabir and in Gobustan).

The designer and the environmental consultants main efforts were focused to avoid as much as possible the crossing of the urban areas of the main settlements located along the Corridor by proposing alternative by pass routes especially in the centre of:

- Dzhangi
- Narimankand- Maraza (now Gobustan)
- Sabir

As explained hereinafter, some budget and environmental constraints specified in paragraph 4.5.1 prevented the adoption of bypasses in Narimankand and in Sabir which could have minimized potential risks related to the road enlargement such as speeding, pedestrian and accidental animal crossing. Nevertheless, bypass measures can, especially in Sabir, be postponed to the next incoming years when local urban development and population increase will be better established and accompanied with sound and appropriate urban planning design for the area. It has also to be noted that if the forecast volume of traffic vehicle till 2030 and the road design characteristics are compared, the achievement of the critical volume of traffic will take enough time to allow future improvements first and the construction of a by-pass later.

To avoid as much as possible the consequence of non-controlled crossings, special measures have been adopted to ensure high standard of road safety as well air and noise pollution reduction (see paragraphs 4.4.1, 4.4.4, 5.1,5.2,7.1.3,7.2.3) according to the outcomes of the public consultation held during the EIA preparation (see Annexes 1 and 2).

In the following paragraphs, tentative options have been analyzed.

Dzhangi

The village of Dzhangi will be partially by-passed by building a new 2 lane road approximately 300m south of the existing road. The new road will be used only for traffic travelling in the direction of Baku whilst the existing road will be devoted for traffic heading for Shamakhi in the opposite direction. This solution does not bring additional costs to the road and at the same time prevent to go through a prone to erosion area located some kilometers away from the village. It also avoids a very high road gradient improving significantly the safety in a segment with a high number of accidents.

The existing road will have safety barriers installed to limit road access and to reduce the opportunities for passing traffic to stop at the shops located along the road. A local access road will be provided, parallel to the existing road, while a junction will be realized at Dzhangi to allow traffic passing to access the village. In this way the shops will be provided with an alternative access way which will grant the customers an easy and safe stop for shopping avoiding negative potential impacts on shopkeepers' economy.

Envisaged Possible impacts

- Decreased noise - part of the traffic will be diverted from properties
- Reduced access – the edge barriers will prevent passing vehicles to stop at roadside businesses
- Reduced access – access to roadside properties will be via local access road
- Reduced access – the barriers will reduce pedestrians (and animals) crossing of the road – alternative means of access will be required
- short term increase of noise and dust pollutions during construction,
- possible traffic congestion – particularly from the borrow pits located close to Dzhangi

Narimankand & Maraza

According to the preliminary design the villages of Narimankand and Maraza will be by-passed at km 75 with a new 4 lane road passing to the South of Darakand and crossing farm land up to the km 86 on the existing road. The by-pass will reduce chances for passing traffic to stop at roadside businesses, while the existing single carriageway through Maraza will be retained for local access providing customers with an easy and safe stop for shopping avoiding negative potential impacts on shopkeepers' economy. Two junctions will be constructed to provide access to Maraza and Narimankand.

This has been changed during the detailed design stage as described in the following paragraphs.

Envisaged Possible impacts

- Decreased noise in Maraza and Narimankand
- Possible increased noise in Darakand
- Reduced access – the by-pass will prevent passing vehicles to stop at roadside businesses in Maraza and Narimankand while the barriers will reduce pedestrians (and animals) crossing of the road – alternative means of access will be required
- Access to roadside properties in Maraza and Narimankand will be via the existing road and new junction
- Sensible footprint on some area ranging from medium to high agricultural value
- Viaduct to be constructed south of Darakand
- Short term increase in noise and dust during construction.

However, during the detailed design stage it has been decided to avoid the by-pass and to make the upgrade of the existing alignment widening the road on the West side. Obviously, in order to ensure the required level of safety, traffic calming measures such as roundabouts, acceleration and deceleration lanes for connecting roads, etc. have been designed for this section.

Sabir

The village of Sabir is reasonably heavily populated. Most of the development is concentrated on the left side of the road (i.e. on the South side), while a mixture of residential properties and commercial activities is established along the right hand side of the road. A cemetery is located in this area too. No access control is foreseen.

The existing road is a single carriageway with shoulders on both sides characterized by significant traffic volumes. In addition to that, several side roads are typical of this section.

Four alternatives were analyzed:

Alternative 1

The existing road through Sabir will be upgraded (on the right side) to a dual carriageway with a median and shoulders. This will involve also the construction of a new bridge to the right side of the existing bridge. The new road will go very close to the cemetery at km 104+00 (approximately 20mt) but it will not require any land acquisition. During the public consultations the alignment was explained to the locals and no objections were raised.

Envisaged Possible impacts

- Increased noise - vehicles passage will be closer to properties, considering that on the right side a new carriageway will be built. Nevertheless, as yet said, the development of Sabir is concentrated on the opposite side; therefore problems will be minimized as much as possible.
- Reduced access – the verge barrier will prevent passing vehicles to stop at roadside shops
- Reduced access – access to roadside properties will be through local access roads
- Reduced access – the barriers will reduce pedestrians (and animals) crossing of the road – alternative means of access will be required
- Short term increase in noise and dust during construction
- Possible traffic congestion during construction
- Increased numbers of trucks passing through Sabir during construction, due to the expected utilization of the local quarries along the River Pirsaat (which runs through Sabir) as construction material sources.

Alternative 2

The road will bypass Sabir village at the km 102 up to the North, crossing a partially deserted and steppe-like lands. The construction of a new bridge, including an interchange, to overpass the Pirsaat River is envisaged. Once the interchange is passed, the road will gradually reach the existing alignment. Land acquisition of low value will be necessary.

Envisaged Possible impacts

- A costly new bridge is necessary with an expensive interchange certainly more expensive due to the construction and land acquisition costs
- Increased numbers of trucks passing through Sabir during construction, due to the expected utilization of local rock quarries along the River Pirsaat as construction material sources
- Reduced access – the verge barrier will prevent passing vehicles to stop at roadside shops
- Reduced access – the barriers will reduce pedestrians (and animals) crossing of the road – alternative means of access will be required

Alternative 3

The road will bypass the village of Sabir at km 100 on the South direction. In the first part the road will cross a hilly area, requiring the construction of a new bridge to overpass the Pirsat River. The second part of the road will cross agricultural land, heading to Shamaki South, down to the artificial lake of Zagalavooy. Land acquisition of medium-high value is required.

Envisage possible impacts

- Construction of expensive new bridge
- Medium - High value land acquisition required
- High footprint on agricultural land
- Decreased value of the property due to property fragmentation
- Reduced access – the verge barrier will prevent passing vehicles to stop at roadside shops in Sabir
- Reduced access – the barriers will reduce pedestrians (and animals) crossing of the road – alternative means of access will be required
- Over passing and possible reinforcement of erosive soil

Alternative 4

The route is the same provided according to alternative 3, the difference being the road which joins the existing road at km 108 with minor impact on agricultural soil.

Envisaged possible impacts

- The possible impacts are the same provided for the Alternative 3 but with less impact on agricultural land.

Final Remarks

The following aspects have been taken into account:

- the volume of forecasted traffic up to the year 2030;
- the advisability to provide the population with by passes in the next 15-20 years, should the volume of traffic that can severely impact the community of Sabir), as presented for example from Table 6 at page 68 and below, according to the actual direction of urban expansion in the east part;
- the strict adoption of road design adequate criteria and safety measures to be used in the urban areas (see chapter 7.2.3 and 7.3.4);
- the contemporary adoption of detailed Master Plan for the community involved to improve the organization of the urban development and spatial planning along the urban area must be done as soon as possible by local municipality;
- the adoption of specific engineering methodologies, proper water channelling measures and techniques to stabilize the slopes prone to erosion and prevent landslides;
- due to the high value of agriculture lands in Azerbaijan, the minimization of agricultural land acquisition, especially in the areas nearby Shamakhi, Sabir and Gobustan and if by passes are not built;
- localization of animal crossings and underpasses for the first section which are in accordance with the international standards and best engineering practice was presented to the public consultation without any objection;
- future detailed design of animal crossings, underpasses and bridges has to comply with the international standards as well the recommendation stated at paragraphs 7.2.3 and 7.2.4 and 7.4

As a result of this analysis, we can confirm that the proposed alignment (alternative n.1) is the most advisable to minimize the environmental and social impacts on the local communities.

Recommendations to be incorporated by road design

The main recommendations to be included in the road design are summarized as follows:

For social safety and security aspects:

1. Round-about at the beginning of each "urban centre" crossed by the new alignment (Dzhangi, Narimankand- Maraza, Sabir and Shamakhi).
2. Third lane on each side, in those "urban centre", whereas possible, to be used for local traffic and mobility together with appropriate sidewalks and bike lanes (especially in Dzhangi, Maraza, Sabir).
3. Installation of speed limit signals at 50 Km/h and 30 km/h near schools, bus stops, mosques and hospitals, medical and health centres.
4. Installation of VCD (video-cam recorder) for speed violation record.
5. Installation of flash speed alert before each pedestrian crossing.
6. Installation of rumble stripe at the beginning of the urban areas and 30 mt and 15 mt before pedestrian crossings (and roundabout).
7. Installation of horizontal pedestrian crossing signals together with islands between the carriage lanes completely illuminated and "Led lights" horizontal signals combined with traditional white strips during the night hours.
8. Use of noise abatement asphalt in all urban sections.
9. Installation of dedicated safety and warning signals (children crossings, mosque, churches, schools, hospitals and medical centres, tourist destinations, police and public buildings).
10. Installation of road illumination lamps every 25 mt in all urban sections on both directions and flash lights during the night and in case of fog, rain and snow.
11. Installation of emergency road side call equipments (pillars) over "lane framework", one each km on both directions.
12. Installation of pedestrian safety crossing islands in the middle of the two carriage ways equipped with flashing traffic light.
13. Appointment of an Architect/Urban designer cooperating with road engineering to prepare detailed design for road ancillary works.
14. To avoid overpasses pedestrian bridge being the above mentioned measures sufficient to secure safety road crossing. The pedestrian bridges were not debated in the public consultation. The observation made in Baku and other cities in Azerbaijan (and some other central Europe communities) demonstrated the unwillingness to use those utilities when not provided with elevators to cross the roads. Sometimes people even cut the protection fences to avoid the overpass increasing the risks of accidents.
15. Completely revise the intersection of the local road with M4, providing for each of them an acceleration and deceleration lane to prevent as much as possible any dangerous contact between the vehicles on the road.
16. Revise the U-turn intersections into roundabout systems to allow users maneuverings as needed.

For animal crossing and wildlife:

The identification of ecological corridors normally requires an observation period of minimum three years with constant presence on the field of a team of specialists. It is clear that the period of time granted for the preparation of this EIA did not allow such activity. Therefore the Consultant based his recommendations on internationally recognized best practices, his experience and the data available in situ suggesting:

- 1 underpass for crossing of wildlife animal every 10 km and/or where migration routes for local wildlife are identified.

On the other hand the location of domestic animal crossing was agreed during the public consultations on the basis of the most convenient place according to the presence of cattle-breeding (folds, sheds, stables, etc.) along the proposed alignment and to the road characteristic. As a result it is recommended:

- 1 underpass for crossing of domestic animals every 5 km or in the proximity of usual crossing points and/or grazing lands and temporary shelters for domestic animals.

The distance of 10 km between the underpasses represents the maximum indicative distance to ensure the transit and the homogeneity of the distribution areas for wild species. The locations of underpasses has been defined in the detailed design of sections one and two, ensuring the smooth transit of wild species including in particular the two vulnerable species of reptiles, namely the protected Greek Tortoise *(Testudo graeca*) and the European Pond Turtle (*EmysOrbicularis*). Underpasses for domestic animals (located every 5 km) can also be used for transit of natural species helping to prevent the crossing of wildlife due to the fragmentation of their habitat.

For prone to erosion soil and landslide protection/potential;

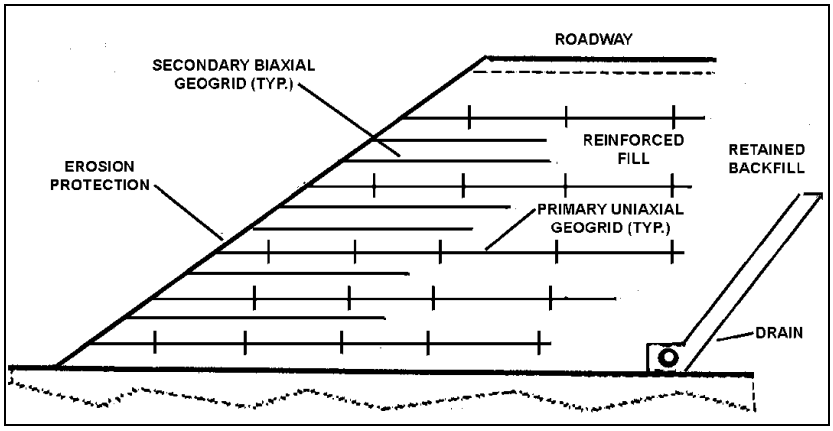
Recommendations include the use of geotechnical engineering technologies for the stabilization of soil prone to erosion as well for the prevention of landslide. Appropriate hydraulic techniques for the channelling of rain and superficial water to avoid water erosion are also strongly suggested.

A proper reinforcement of soil would allow utilization for widening and reconstruction of existing road. The use of reinforced steepened slopes to widen the project road would improve mass stability, reduce fill requirements and eliminate additional crossings.

The main components of reinforced or mechanically stabilized soil embankments are schematically shown in Figure 1.

Reinforcements in the fill soil create a structurally stable composite mass. Main tensile elements are referred to as primary reinforcement. Shorter, intermediate inclusions may be placed near the slope face. The secondary reinforcing elements are used to minimize sloughing or face sliding and to support compaction and alignment control. The soil at the outer edge of the slope may also be faced with some kind of netting (e.g., coir or jute) to prevent or minimize soil erosion.

Figure 1 - Material and structural components of a typical, reinforced steepened slope



The use of live-cut brush layers as a supplement or as alternative can be substituted for the secondary reinforcements or, in some cases, actually replaces both secondary and primary reinforcements.

This approach defined as soil bioengineering entails the use of living vegetation, primarily cut woody plant material that is purposely arranged and imbedded in the ground in selected patterns and arrays to prevent superficial erosion and arrest shallow mass movement. It is supposed to be permanent solution as these reinforcements create in the fill soil a structurally stable composite mass.

Brush layering consists of inserting live, cut branches or brush between successive layers of compacted soil as shown in Figure 2, Figure 3 and Figure 4 with willingness to take root. This process works best when done in conjunction with the construction of a fill slope. The tips of the branches protrude just beyond the face of the fill where they intercept rainfall, slowing runoff and keeping sediments out of the slope runoff. The stems of the branches extend back into the slope in much the same manner as conventional, inert reinforcements, e.g., geo-textiles and geo-grids, and act immediately as tensile inclusions or reinforcements.

Figure 2 - Hedge with cuttings

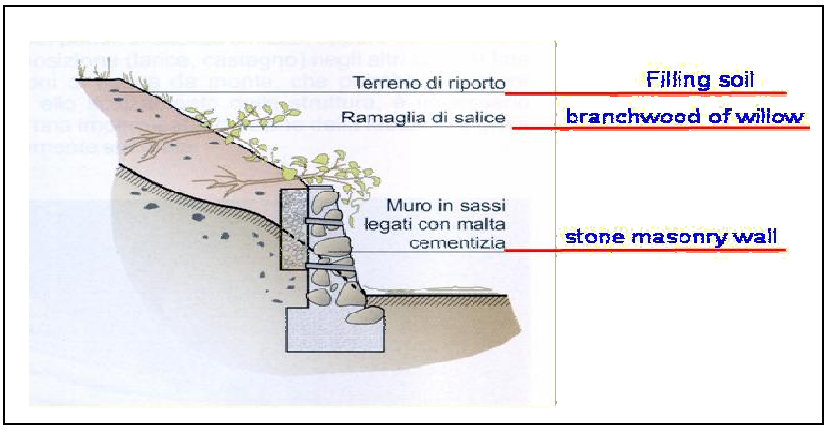


Figure 3– Timber grating with cuttings

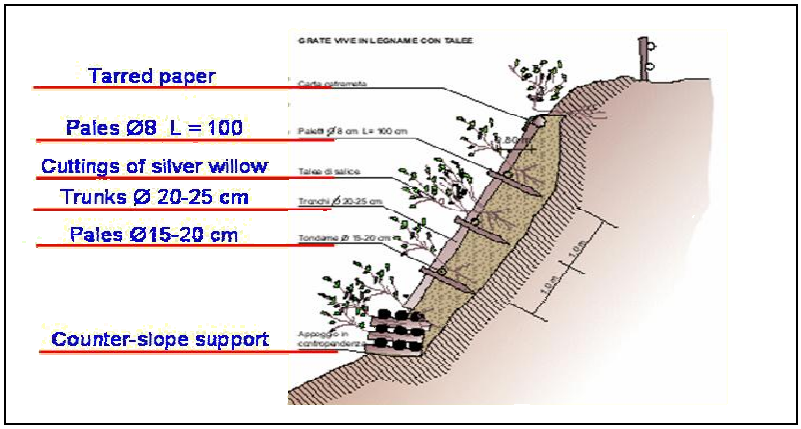
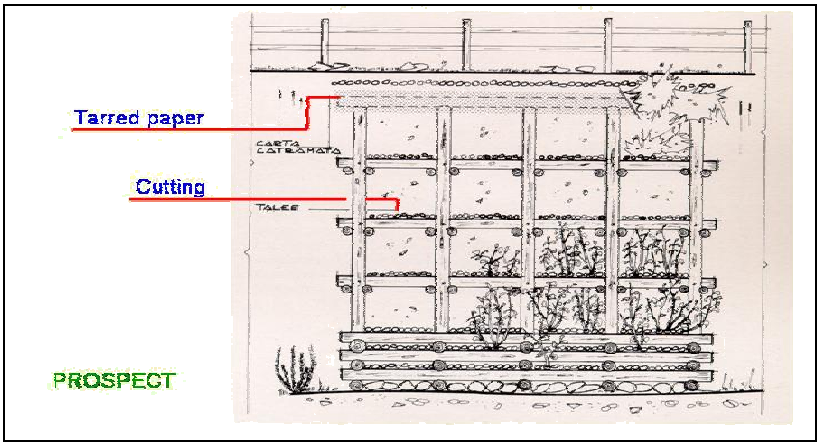


Figure 4 – Timber grating with cutting (Prospect)



Identification of main mitigation measures related to "vegetation cover"

Roadside vegetation performs a wide variety of significant functions in the road surroundings.

The vegetation cover permits in a considerable degree to restore the balance to the natural environment, disturbed by the road infrastructure development. Moreover, suitably selected plant species efficiently counteract the forces occurring in nature and protect road slopes i.a. against surface erosion or landslides.

Roadside vegetation improves traffic safety (e.g. by protection against glares or a sudden intrusion of animals onto the road) which, with the current development of motorization and a large number of accidents, becomes of paramount importance.

The issue of "vegetation cover" usually concerns the whole Project area included the construction sites[1].

As for the Baku-Shamakhi road, the section from Maraza to Sabir is more interested by "vegetation cover" measures.

The table on paragraph 2.3 describes the main mitigation measures proposed to minimize the impact on "vegetation cover".

Vegetative protection and covers should consist of native species of shrubs and grasses which have special properties to hold earth and survive the environmental conditions of the area. Road Maintenance Department of the AzerRoad Service (ARS) is expected to be in charge for the maintenance of the vegetation.

[1]The new earthworks such as the embankments and excavation slopes are entirely devoid of green cover, to reduce the adverse effect of road network development on nature that surrounds it. To achieve this goal a number of measures have to been applied. Among these measures worthy of particular note is vegetation cover where plants are used as a natural factor that protects and enriches the environment. The purposes of vegetation cover encompass;
• biological functions: these come down to restoring the natural balance in the disturbed landscape;
• engineering functions: protection of soil surface against erosion, as well as improvement of earthworks stability;
• environmental functions: protection of zones and protection against the effects of the elements (atmospheric phenomena), noise control for the adjacent areas and reduction of exhaust gases spreading.

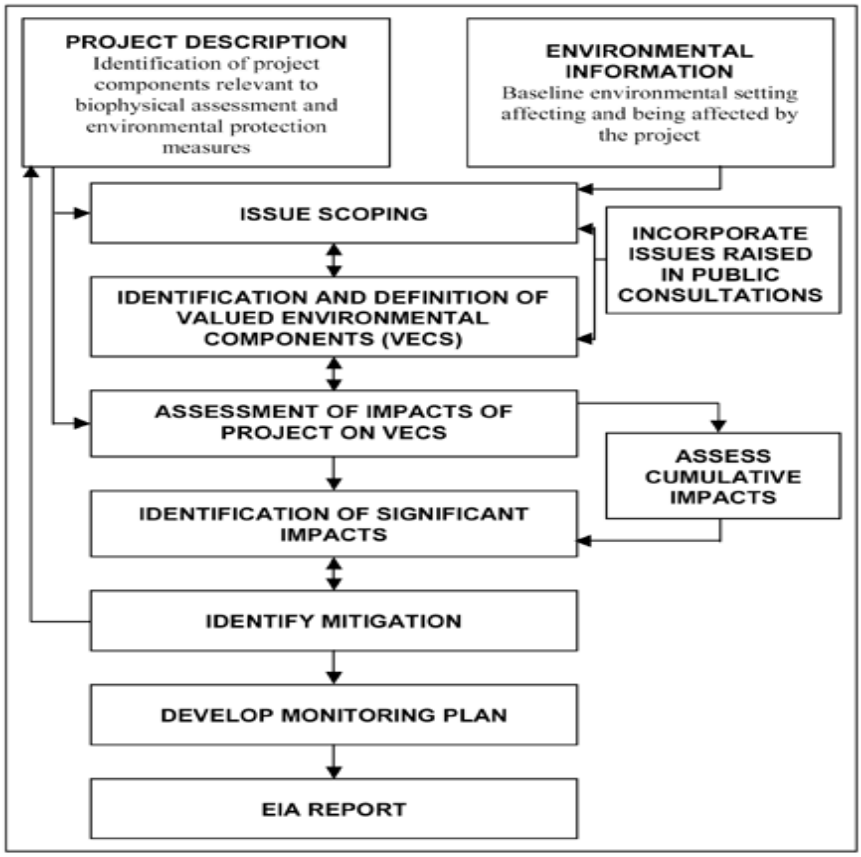
2 POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

2.1 EIA process

"Environmental impact assessment" (EIA) is a comprehensive and systematic process designed to identify, analyze and evaluate the environmental effects of proposed projects. The EIA:

- involves the population in an open and participatory manner
- allows for the effective integration of environmental aspects and public concerns into decision-making
- is a powerful tool to support decision-makers achieving a sustainable development.

This introduction is meant to describe a generic EIA process as detailed in the following figure, rather than one specific requirement according to a particular jurisdiction. We deem important to highlight the standard EIA process in order to make aware the Employer, future contractors and Engineers about the iterative process held to prepare this study.



2.2 Legislation with reference to Environmental Assessment

The Constitution of Azerbaijan, adopted in 1995 and amended in 2002, includes the right of citizens to a healthy and clean environment. The Constitution also outlines the division of environmental responsibilities between central and local authorities. The 1992 Law on Environmental Protection and Utilization of Natural Resources introduced, among other things, the polluter-pays principle. This opened the door for the use of economic instruments, envisaged the bridging of the gap between existing and international environmental standards, and enhanced the role of public awareness. Activities gathered pace with the political stabilization after 1995. The Law on Environmental Protection and the Law Environmental Safety of 1999 are central. Among other provisions, Chapter 7 of the Law on Environmental Protection defines practices and procedures for conducting environmental expertise.

Although the Law was adopted after the preparation of the EIA Handbook in 1996 (see below), there is no reference to the provisions of the Handbook in the Law. The other key document providing guidance for EIA is the Handbook on the Process of Environmental Impact Assessment in Azerbaijan (1996).

The EIA Handbook introduces the main principles of the EIA process. It defines EIA as a process aimed at identification, evaluation, mitigation and/or avoidance of possible negative impacts of development proposals, but it also mentions principles of integrated approach of such assessments. It is acknowledged the introduction of transparency in the process of decision-making through the involvement of the interested public in the discussion of the proposed activities. The EIA application may be submitted to the head office of the MENR or to a local branch office. In the process of reviewing the EIA application the MENR evaluates the following criteria:

- whether the proposed project envisions new technologies
- the volumes and complexity of the proposed processes or technologies
- the expected environmental consequences
- whether the proposed project would create significant changes for the local population
- public response to the proposal.

However, the major drawback of the EIA Handbook to date has been its non-binding nature (this document was acknowledged and approved by the former State Committee for Ecology and has never passed any formal ratification).

Other laws (as listed in the following Table), governing specific issues such as sanitary-epidemiological welfare, land reform, energy, health, water, forests, cadastre and land use, industrial and domestic waste fauna, fish breeding, ecological safety, water supply and wastewater, atmospheric protection and specially protected areas, have been adopted since 1992. A Comprehensive Action Plan on Improving Ecological Situation of Absheron (2006-2010) was approved in September 2006.

Main Environmental Laws	Year adopted
Environmental Protection Law http://www.tamizshahar.az/files/uploader/q24.pdf http://www.cawater-info.net/library/rus/az_ohr_okr_sr.pdf	1999
Environmental Safety Law http://www.iswm.az/images/stories/Legislation/ekoliji_tehlukesizlik_qanun.pdf http://www.cawater-info.net/library/eng/az_env_saf.pdf	1999
Specially Protected Natural Areas and Objects Law http://e-qanun.az/files/framework/data/4/c_f_4572.htm	2000
Radiation Safety of Population Law http://sehiyye.gov.az/radiasiya_ferman.html	1997
Sanitarian-epidemiological Safety Law http://e-qanun.az/files/framework/data/7/f_7916.htm	1992
Protection of Atmosphere Law http://e-qanun.az/files/framework/data/3/c_f_3563.htm	2001
Soil Code http://www.agro.gov.az/index.php?cat=11&id=21&ses=14f2a	1999
Industrial and Domestic Wastes Law http://www.vertic.org/media/National%20Legislation/Azerbaijan/AZ_Law_Industrial_Consumer_Waste.pdf	1998
Water Code http://www.dejure.az/qanunlar/1415-su-tchizat-v-tullant-sular-haqqnda-qanun-723-iq	1997
Radioactive Wastes Law http://www.vertic.org/media/National%20Legislation/Azerbaijan/AZ_Law_Industrial_Consumer_Waste.pdf	1994
Soil Productivity Law http://socar.az/uploads/socar6.pdf	2000

2.2.1 Rules and Laws governing Biological aspects

The legislative framework of the country, after Azerbaijan gained its independence, was re-drafted in line with modern international standards. A number of 23 laws have been passed which deal with various issues related to the use and protection of biodiversity and are directed to the environmental protection, soil conservation, internal waters, fauna and flora protection, and fisheries. Of particular note is the decision of the Republic of Azerbaijan "On Environmental Protection" (8 August 1999) which represents the main legislative document about nature conservation and sustainable use of land, forest and water habitats.

- "Law on Plant Protection" (1996)
- "Water Code" of the Republic of Azerbaijan (1997) defines the legislation relating the protection of water and includes several types of aquatic habitats including: rivers, lakes, the Caspian Sea, wetlands, riparian habitats, river catchments, water sources, and other wetland areas related with protected natural resources
- "Forestry Code" (1997)
- "Law on Fisheries" (1998)
- "Law on Fauna" (1999)
- Law on Environment Protection (1999) of the Republic of Azerbaijan defines the protected area estate and buffer zones
- Land Code (1999) defines the actual types of areas protected by the State for biodiversity
- "Law on Protected Areas" (2000)

- "Law on national parks and reserves (2003).

The Ministry of Ecology and Natural Resources and the Ministry of Agriculture ensure the effective implementation of the relevant laws and resolutions, and the identification of the necessary implementation activities:

- "Law on pesticides and agrochemicals (1997)
- "Law on industrial and domestic waste (1998)
- "Law on water supply and waste water (1999)
- "Law on environmental protection (1999)
- "Law on ecological security (1999)
- "Law on atmospheric pollution (2001)
- "Administrative Code of the Republic of Azerbaijan" (38 articles) and "The Criminal Code of the Republic of Azerbaijan" (15 articles) establishes the penalties for violation of the laws described in previous sections and define the penalties appropriate for individuals and companies for offences against environmental protection, use of natural resources, or ecological safety laws.

Other relevant Laws to the road sector in Azerbaijan:

Azeri Law on Automobile Roads (March 10, 2000).
Section 39: Protection of the Environment states that any construction or reconstruction of roads requires the official approval of the Ecological Committee. The unit of the Ministry responsible for road environment must approve the proposed environmental, health and safety norms of the construction.

SNIP 2.05.02-85 Building Code & Regulations for Automobile Roads Ch. 3: Environmental Protection.
Indicates the general need to minimize adverse environmental impacts in road design and provides for instructions on the removal and re-use of top soil; the need to provide buffer between the road and populated areas and to carry out noise reduction measures to assure compliance with the relevant sanitary norms; on the dumping of excess materials.

Safety Regulations for Construction, Rehabilitation and Maintenance of Roads 1978.
Comprehensive compilation of safety rules to technical safety requirements of road construction equipment, operation and maintenance of asphalt plants, work in borrow sites, loading and unloading operations, work with toxic substances, etc.

Guidelines for Road Construction, Management and Design, February 7, 2000.
Part I: Planning of Automobile Roads Part II: Construction of Automobile Roads Part III: Protection of the Environment Addresses environmental issues in road design, construction and maintenance. It requires minimization of impacts on the ecological, geological, hydro-geological and other ecological conditions, by implementing adequate protective measures. It also requires appropriate protection measures, which shall contribute to the maintenance of stable ecological and geological conditions.

BCH 8-89 - Regulations on Environmental Protection in Construction, Rehabilitation and Maintenance of Roads.
Comprehensive provisions on environmental protection measures in road construction such as use of soils, protection of surface and groundwater resources, protection of flora and fauna, use, preparation and storage of road construction machinery and materials, servicing of construction machinery; provisional structures, provisional roads, fire protection, borrow pits

and material transport, avoidance of dust, protection of soils from pollution, prevention of soil erosion etc.

SNIP II-12-77, Chapter II: Norm of designing for noise protection.
Identification of different noise sources, full list of maximal noise level for different areas (residential, hospitals, industrial etc.) in different daytime, technical description of different measures for noise level reduction etc. are present in the document.

Reg. 514-1Q-98 Regulation on Industrial and Municipal Waste.
This law includes requirements for industry and enterprises on the implementation of identified standards, norms and environmental protection for waste when designing, constructing or reconstructing.

GOST 13508-74
It describes the requirements and standards for white lining (road markings) for the various road categories.

Law of the Azerbaijan Republic on Fertility of Lands.
This Law shall established legislative provisions related to reinstatement, increase and protection of fertility of state, municipal and private lands in the Azerbaijan Republic.

The law of the Azerbaijan Republic on ecological safety No 677-IG
This Law includes establishment of the legal framework for the purpose of protection of lives and health of individuals, the public, material and moral values thereof, the environment, including atmospheric air, cosmic space, water objects, subsurface, soils, natural landscapes, flora and fauna from hazards which may arise as a result of impact of natural and anthropogenic factors.

Presidential decree on "Creation of Nature Reserve for group of mud volcanoes of Baku and Absheron peninsula" 15 August 2007
This decree is an addition to the Law on Protected Areas (2000) and includes establishment of the legal framework for the purpose of protection of unique landscape forming by mud volcanoes occurring on the area.

Rules for Use, Protection and Preservation of Trees and Bushes which are not included to the Forestry Fund of Azerbaijan Republic (No 173; 19 of September, 2005)
This document includes detailed description of trees and shrubs that are not included to the forestry Fund and the way of their protection as well as the exclusions and the regulation in case of necessity of their cutting or replanting.

Source: Finnroad (2005) Tovuz Bypass Project with additions.

Categories of protected area in Azerbaijan

In order to preserve areas of natural importance from the negative effects of human activities protected areas are established. The following categories of protected area are foreseen in Azerbaijan:

- **strict nature reserves** including biosphere reserves, are state-owned, strictly protected areas designated for nature protection and scientific research. No economic activity is allowed. They have management plans and both enforcement and scientific staff.
- **wildlife sanctuaries** are designated for nature protection, but limited human activities - for example agriculture - are permitted according to certain regulations, provided that they do not adversely affect nature conservation. Land title is retained by the original owners.

- **national parks** are areas with ecological, historical, and aesthetic values, designated for nature protection, environmental awareness, scientific, cultural and other purposes. All land and natural resources belong to the Park management authority, and some economic activities (including ecological tourism) are allowed.
- **natural monuments** are protected objects that have ecological, cultural or aesthetic value. They range in size from individual trees (of which 2,083 over 100 years old are designated) to patches of ancient forest, and also include caves, paleontological sites and landscapes. Their destruction or damage is strictly forbidden.
- **zoological parks or gardens**.
- **botanic gardens** and **dendrological parks**.
- **health spa's and resorts**.
- **natural parks** may be designated for protection and recreation. There are currently none in Azerbaijan.
- **ecological parks** may be created for promoting environmental awareness. There are currently none in Azerbaijan. The Ministry of Ecology and Natural Resources manages these reserves, including two National Parks, the Strict Nature Reserves, Wildlife Sanctuaries and Natural Monuments.

The conservation status of species of flora in Azerbaijan

The conservation status of species of flora and fauna has been assessed with reference to:
- the Red Data Book (RDB) for Azerbaijan (1989)
- information from local scientists on proposed additions to the Red Data Book (pRDB)
- the 2000 IUCN Red List of Threatened Species
- European Bird Populations: Estimates and Trends (Birdlife International/ European Bird Census Council, 2000).

Description of conservation status categories is described below:

Table 1: Threatened species status categories

Status Category	Description
Ie	Species of International Conservation Concern – endangered
Iv	Species of International Conservation Concern – vulnerable
Ilr	Species of International Conservation Concern – low risk
Ee	Bird of European Conservation Concern - endangered
Ev	Bird of European Conservation Concern - vulnerable
Er	Bird of European Conservation Concern – rare
Ed	Bird of European Conservation Concern - declining
RDB	Listed in Red Data Book of Azerbaijan Republic
PRDB	Proposed for inclusion in Red Data Book of Azerbaijan Republic

Institutional Framework – Environment

The Ministry of Ecology and Natural Resources is the key environmental institution in Azerbaijan. The MENR was established by the former State Committee for Ecology and Natural Resources Utilization and was established by Presidential Decree in 2001.

The MENR's activities are sub-divided into the following main areas:
- environmental policy development
- environmental protection
- water monitoring and management

- protection of marine (Caspian Sea) bio-resources
- forest management
- bio resources and protected areas management

The MENR's State Ecological Expertise (SEE) department is responsible for the review and approval of environmental impact assessments (EIAs) submitted by developers. Another Government institution involved in the preparation and implementation of the Project is the ARS (AzerRoad service), in particular the Highway II Project Implementation Unit and the Ecology and Safety Sector (ESS), a department established under the ARS's. ARS's ESS hasthe responsibility for ensuring the implementation of the recommendations contained in the EA and for ensuring compliance with national environmental standards.

In the Country there are over 60 ecological Non-Government Organizations (NGOs).

Biodiversity

Azerbaijan is a Member of most international agreements and conventions relating to biodiversity.

International environmental conventions ratified by Azerbaijan:

- UNESCO Convention on Protection of World Cultural and Natural Heritage 1994
- UN Framework Convention on Climate Change 1995.
- UN Convention for the Protection of the Ozone Layer (Vienna Convention) 1996
- Fauna and Flora (CITES), and Agreement on Protection of Sturgeons 1998
- UN Convention to Combat Desertification (CCD) 1998
- Agreement on Mutual Cooperation of Commonwealth of Independent States in the area of Hydrometeorology 1998.
- UNECE Convention on the Protection and Use of Trans-boundary
- UNECE Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (Aarhus Convention) 1999.
- Convention on Conservation of European Wildlife and Natural Habitats (Bern Convention) 1999.
- UNECE Convention on Environment Impact Assessment in the Trans-boundary Context (Espoo Convention) 1999.
- Watercourses and International Lakes (Helsinki Convention) 2000
- FAO Convention on Plant Protection 2000
- UNESCO Convention on Wetlands of International Importance especially as Waterfowl Habitat' (Ramsar Convention) 2000
- Protocol on UN Framework Convention on Climate Change (Kyoto Protocol) 2000
- Protocol on Substances that Deplete the Ozone Layer (Montreal) 2000
- European Agreement about Transportation of Dangerous Loads on International Routes 2000
- UN Convention on Biological Diversity (CBD) 2000
- UN Convention on the Control of Trans-boundary Movements of Hazardous Wastes and their Disposal (Basel Convention) 2001
- UNECE Convention on Long-range Trans-boundary Air Pollution 2002

2.2.2 Rules and Laws governing Air and noise aspects

According to the standards usually adopted in Azerbaijan, the maximum allowable noise levels are those presented in the next table.

Table 2 - Maximum allowable noise levels (GOST standards)

Land use	Noise standard (max) in decibel (dBA)	
	Daytime (07:00-23:00)	Night time (23:00 - 7:00)
Residential Areas	40	30
Commercial Areas	55-60	55-60
Hotels and dormitories	45	35
Industrial areas:		
a) highly qualified workplaces	50	50
b) permanent workplaces within territory or buildings of plants	80	80
c) workplaces of track drivers and service	70	70
d) workplaces of drivers and service for tractors and other equivalent agricultural and improvement mechanisms	80	80
Sensitive areas:		
a) hospitals and sanatoriums	35	25
b) schools, libraries and conference halls	40	40

Source: Noise Standards GOST 12.1.003-83 UDK 534.835.46:658.382.3:006.354; GOST 12.1.036-81 ST SEV 2834-80

The above values are derived from standards adopted by the former Soviet Union and are very strict. They are referred to indoor noise.

2.2.3 World Bank's Safeguard policies

The World Bank's environmental and social safeguard policies are regarded as a cornerstone to support the sustainable poverty reduction. The objective of these policies is to prevent and mitigate undue harm to people and their environment in the development process. These policies provide guidelines for the World Bank and borrowers in the identification, preparation and implementation of programs and projects.

Environmental Impact Assessment (EIA)

The World Bank's environmental assessment policy and recommended processing are described in Operational Policy (OP)/Bank Procedure (BP) 4.01: Environmental Assessment. This policy is considered to be the 'umbrella' policy for the World Bank's environmental 'safeguard policies'. For the present Project, the relevant safeguard policies to be considered at all stages of preparation and planning are:

- Involuntary Resettlement (World Bank OP/BP 4.12);
- Natural Habitats (World Bank OP/BP 4.04: Natural Habitats 2001);
- Forestry (World Bank OB/BP 4.36);
- Management of Cultural Property (World Bank OP 11.03).

Word Bank requirements and local legislation

Involuntary resettlement

The World Bank OB/BP on Involuntary resettlements requires WB- assisted projects to avoid or minimize involuntary land taking. The policy requires that if involuntary land taking and resettlement become necessary, a clear plan for compensating and assisting displaced people is prepared by the borrower for the World Bank's review ;

Local Legislation

- the laws and regulations on land acquisition and resettlement (LAR) in Azerbaijan; and
- A Resettlement Framework for the Road Network Investment Program (the Program) dated June 2007 established the principles and procedures for the compensation of land,

houses, buildings, crops and livelihoods to be affected by the Program. The Resettlement Framework was prepared by the Government, endorsed by the Ministry of Transport and disclosed in June2007.

Natural Habitat

The World Bank OP/BP on Natural Habitats seeks to ensure that WB-supported infrastructure and other development projects take into account the conservation of biodiversity as well as the numerous environmental services and products which natural habitats can provide to human society.

Azerbaijan is signatory to the convention on biological diversity which seeks to ensure conservation of biological diversity and sustainable use of its components.

Local Legislation

- "Law on Plant Protection" (1996)
- "Water Code" of the Republic of Azerbaijan (1997) defines the legislation relating the protection of water and includes several types of aquatic habitats including: rivers, lakes, the Caspian Sea, wetlands, riparian habitats, river catchments, water sources, and other wetland areas related to protected natural resources
- "Law on Fisheries" (1998)
- "Law on Fauna" (1999)
- Law on Environment Protection (1999) of the Republic of Azerbaijan defines the protected area estate and buffer zones
- Land Code (1999) defines the actual types of areas protected by the State for biodiversity
- "Law on Protected Areas" (2000)
- "Law on national parks and reserves (2003
- "Law on environmental protection (1999)
- "Law on ecological security (1999)

Forestry

The World Bank OP/BP on Forestry aims to reduce deforestation, enhance the environmental contribution of forested areas, promote a forestation, reduce poverty encourage economic development.

Local legislation

- Forestry Code (1997)

Cultural Property

The World Bank OP on Cultural Property is based on the acknowledgement of cultural resources such as sources of valuable historical and scientific information as assets for economic and social development, and as an integral part of a people's cultural identity and practices (OD 4.50 and OP 11.03).

Local Legislation

- Law on Protection and Utilisation of the Cultural and Historical Monuments'
- Law of the Republic of Azerbaijan on Legal Protection of Expressions of the Azerbaijan Folklore

Public Consultation and Disclosure

The World Bank's policy on Public Consultation and disclosure follows specific procedures:

- EIA reports have to be presented to both Government of Azerbaijan and the WB management and serve as a background document for approval by the competent authority. In accordance with OP/BP4.01 the Borrower (the Government of Azerbaijan) have to present the EIA Report and the Land Acquisition Plan at a public place accessible to consultation for project affected groups and local NGO's.

Local Legislation

- Handbook for the Environmental Impact Assessment Process in Azerbaijan 1996.

3 DESCRIPTION OF THE PROJECT

3.1 Objectives and purpose of the project

The Project Specific objectives are:

- to ensure the smooth implementation and the satisfactory preparation of the Environmental Impact Assessment and Environmental Management Plan within the allocated budget, quality standards, in line with relevant national and international requirement's and the Bank's policies on safeguards and the disclosure of information and according to the time-scale stated in the Contract
- to fulfil the reporting requirements as defined by the Terms of Reference
- to timely mobilize and set up of the Consultant's team
- to gather and review the existing documentation
- to collect and analyse additional documents and information regarding geology, hydrology, land use and other issues
- to concentrate on key departure points stated agreeing with the Employer for further activities of the Consultant
- to comply with Azeri law and World Bank's policy, both of which include environmental and social lifeguards.

3.2 Limits of the investigation area

Several surveys and investigations on socio economic issues were carried out for the main villages and settlements along and nearby the road alignment taking into account:

- **Direct impacts.** Those impacts affecting all the buildings (residential, commercial, industrial, etc.) located in the proximity of the road. These effects are a direct consequence of the presence of the road and can only be mitigated (e.g. air and noise pollution, separation of adjacent areas, etc.). Several studies on traffic have proved that all the facilities within a range of 500m from the road axis (250m on each side) are affected by direct impacts.

- **Indirect impacts**. Namely all the effects that the urban area along the road receives due to the presence of the road; they can involve urban and social development, starting of new activities, re-organization of public services, etc. The identification of the areas affected by this category of impacts is based on the time necessary to reach the road. If this time is too long, the area will probably not feel the effects brought by the presence of the new road. A time of access of 25 minutes is normally considered the limit for an urban area to receive the effects of the presence of a new infrastructure. With reference to the project, at this duration corresponds the village of Sabirli which is 13.3 Km far from the road. Hence the value stated hereinafter in this report.

The surveys included:

- villages and settlements directly affected by the enlargement of the Baku – Shamakhi road

in a range of 250 meters from the edges.
- all economic activities directly affected by the enlargement localized in a range of 250 meters from the edges.

The villages and settlements directly affected were:
- Dzhangi and Dzheirankechmaz (Gobustan Rayon)
- Gobustan (former Narimakand- Maraza villages) in Gobustan Rayon
- Sabir,Shahriyar and Shamakhi

Also villages and settlements indirectly affected by the enlargement of the Baku- Shamakhi road, within a distance from the alignment between 500 mt up to 13,3 Km, were surveyed along all the three sections (from km 45+600 to km 121+000). Affected villages and settlements are:

GOBUSTAN RAYON:		
Name	**Distance from Baku-Shamakhi Road**	**Population**
Darakand	1,7	432
Takla-Mir	8,3	2.219
Jam-Jam	7,8	1.272
Arabshalt	9,33	4.230
Takla	3,5	2.035
Chalov	6,2	1.600
Chukhani	5,6	810
Jayrli	8	2.500
Badelli	2,3	738
Sadafli	2	358
Uzumchu	2,1	370
Total Villages		**11**
Total Population		**16.564**

SHAMAKHI RAYON		
Name	**Distance from Baku-Shamakhi Road**	**Population**
Carkhan	8,1	2.890
Garavelli	2,7	1.254
Malcek	1,9	434
Angikharan,	6,1	860
Boyuk Kinisli	4,7	483
Nuydu	11,6	714
Chiraqli	3,3	248
Marzaddiya	1,2	1.131
Adnali	8,7	961
Sabirli	13,3	376
Karkanc	10,4	742
Kakakhana	6	362
Madrasa	5,3	2.157
Nirikand	0,6	994
Total Villages		**14**
Total Population		**13.606**

It is estimated that the total population directly and indirectly affected by the enlargement of the new road is of 72.274 people out of whom the 42% (30.170) is represented by population living in villages in the rural area and the 58% (42.104) in urban areas. It can be assumed that in the next years the population living in urban areas will increase for a combined effect of improved living conditions and job opportunities. Nevertheless the backbone of the rural territory made of a large number of villages and settlements (25) together with the touristic villages will characterize the whole area. New economic development is expected with the construction of vacation homes and hotels and tourist accommodation especially near the mountains and panoramic areas to the west of Shamakhi, including the Ismailli and Pirkuli natural reserves. The area to the west of Shamaki together with Ismailli and Pirkuli is very attractive both for the week-end and for the summer and winter seasons. The fact the area becomes accessible from Baku in less than two hours by car will be of great importance for the local economy.

The complete set of performed surveys and investigation is reported in the Annex 4.

4 DESCRIPTION OF THE ENVIRONMENT

4.1 Physical and Biological Environment

4.1.1 Biological Environment

The physical environment of the region is characterized in the east part of the road by plains that gradually transforms in arid hills and lower mountains (foothills zone of the greater Caucasus) with an altitude ranging between 300 m to 800 m above the sea level nearby Shamakhi. The climate in the eastern part is semi-desert, replaced by steppe-like landscape in the western part of the studied corridor and showing a series of landslide areas at the km 60; 81,5; 109; 110; 132,6 along the alignment of the road. The climate condition of the area is characterized by hot and dry summer, moderately warm winter with dominant wind from the west/north-west quadrant in the east section up to Dzhangi and from west in the west section, with respective 200 and 300-450 mm of annual precipitations. The Absheron-Gobustan zone is heavily characterized by drought and desertification. Surface waters of the area are composed by few small seasonal rivers, the main are the Pirsaat Chay (length 199 km; basin area 2280 km2) closer to Sabir Village, Sumgayit Chay and Ceyrankechmez that run dry for several months including summer period, carrying water mainly from Caucasus snowmelt, precipitation and springs. These rivers generate some small lakes and ponds often man-made that evolved in seasonal wetlands ecosystem (Ajideresu river), for watering flocks and cattle. Numerous small wetlands are located along the proposed route. The river is crossed by the proposed route and due to the variable and often turbid flow, it presents the associated vegetation limited to the bank sides and seasonally inundated embankments; the riverside vegetation generally comprises scrub and tree species such as tamarisk species (Tamarix ramosissima), oleaster (Elaeagnus angustifolia). Several man-made lakes and ponds occur along the proposed route, showing vegetation very similar to the river one, being dominated by common reed (Phragmites australis) and tamarisk species (Tamarix spp).

Flora in Azerbaijan

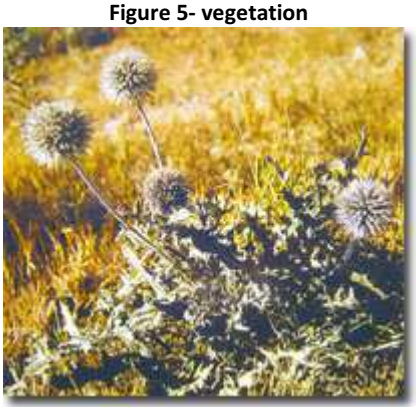
From a general point of view the Republic of Azerbaijan has a very rich flora and high level of biodiversity. There are more than 4,500 species of high plants here. The flora of Azerbaijan is richer in the number of species than the flora of the other republics of the South Caucasus. The sixty-six percent of the species growing in the whole Caucasus can be found in Azerbaijan. The richness of Azerbaijan's flora and the variety of its vegetation result from the variety and richness of its physical-geographic and natural-historic conditions and from its compound history, influenced by the remote floristic regions. There are 240 endemic species of plants in Azerbaijan. In the flora of Azerbaijan there are representatives of all the types of floristic areas, e.g. ancient wood, boreal, plain, xerophytic, desert, Caucasian and accidental. Vast areas are covered with desert and semi-desert vegetation. Three kinds of Salsoletum colonize in wide and fruitful semi-deserts in the Kura-Arazlowland. Especially Salsola nodulosa creates deserts, or semi-deserts on developed soils, independently or with the Artemisia fragrance wormwood. The Salsoletum dendroides desert formation coincides with slightly saline soils and contains dozens of ephemeral and sub-ephemeral species. These communities produce

semi-desert thickets with wormwood, Alhagi and Glycyrrhiza. There are 22 species of Salsola in Azerbaijan, most of them creating formations. In the Shaki plateau region thickets of these species are observed in slightly saline habitats, being very bright and colourful when bearing fruit.

Wormwood formations (Artemisietum) are the most widely spread type of desert vegetation. It is mainly developed on fine-earth alkaline gray soils of low salinity. They often produce in the semi-desert area colony formations with Salsola species or perennial cereals. All the kinds of Artemisietum include 30-35 or even 50-55 species of ephemeral and sub-ephemeral plants. E.g., Poa bulbosa, Bromus japonicus, Lolium rigidum, Eremopyrum orientale, Erodium cicutarium, Medicago minima, Medicago coerulea, etc. are believed to be constant members of wormwood formations. Low shrubs also occur in those communities.

As for the semi-steppe and steppe vegetation, it mainly includes copiously spread cereals, such as Festuca, Stipa, Agropyrum cristatum, and also Medicago transcaucasica, Centaurea reflexa, Gypsophyla steveni, Teucrium polium and other perennial and annual species. Mountainous xerophytic vegetation often mixes with steppe formations, producing particular communities.

Figure 5- vegetation



Flora in the project area

Along the road from Baku to Shamakhi the flora has two main components, perennial plants and annual ephemeral plants. Flora is composed by saltwort vegetation in first part of the study corridor and arid steppe vegetation more than arable and irrigable agricultural field closer to Narimankand and Sabir Village. The main vegetal species of the area are represented by Wormwood formations: *Artemisia hanseniania*, Saltwort formations: *Salsola Dendroides*, Shrub vegetation: Tamarisk, Juniper shrub and Ephemeral grasses: Tulips (*Tulipa sp.*), Iris (*Iris sp.*), Feather grass (*Stipa sp*.), Cereals (*Andropogon sp*. etc) Bushes (*Pirus sp. Amigdalusfenzliana* etc) Flower species: *Euphorbia helioscopia, Veronica chamaedrys, Leontodon hispidus,Cirsium arvensis,Erodium cicutarium, Arnebia linearifolia, Sisymbrium officinadale, Ammi visnaga, Cicorium intibus,Calendula sp*. *Papaver sp. Salsola sp.,Eryngium planum Echinops ritro.* Thirteen Species of plants can be found in the Red Data Book of Azerbaijan and are present in the Baku-Shamakhi desert/semi-desert region, namely: *Anabasis brachiata, Astragalus bakuensis, Acantholimon schemachense, Avena ventricosa, Cladocheta candissima,Calligonum bakuense Ferula persica, Iris acutiloba, Iris reticulata, Muscari elegantulum, Pyracanta coccinea,Stipa pellita,Tulipa biebersteniana.*

Figure 6 -State Forest Fund

The corridor area includes also several reforestation zone implemented by the State Forest Fund (S.F.F) mainly registered along the road project in Dzhangi, where it is present one of the longest strip plantation (less than 1m high) and between Km 74,6 and 76,4, tall trees close to the road in Maraza and Shamakhi Villages (Figure 6). The main plant species of these artificial trees plantation (mainly planted in 1973 and 2003) are represented by Cypress, Pine, Oleaster, Willow, Acacia, Almond, Apple, Elm, Fustic, Poplar, Oak, Ash. Unfortunately a certain number of trees were infected by a fungal infection, and six trees are been identified for future plantations: Elm, Oleaster, Gleditschia, Poplar, Maclura and Fustic.

Fauna in Azerbaijan

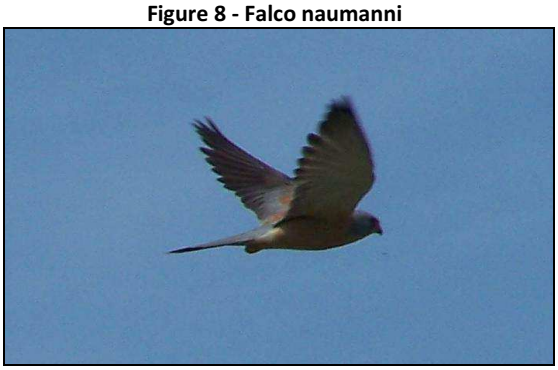
The fauna of Azerbaijan is represented by 99 species of mammals, 360 species of birds, 54 species of reptiles, 11 species of amphibians, 95 species of fish and 14,000 species of insects and particularly important for some groups, especially birds and bats.

Figure 7 -*Barbastella barbastellus*

Fauna in the project area

Among the main groups of Mammals present in the area the following species are observed in the project area: Jackal (*Canis aureus*),Wolf (*Canis lupus*), Red Fox (*Vulpes vulpes*), Badger (*Meles meles),* Wildcat (*Felis libyca),*Hare (*Lepus europaeus*) Western Barbastelle Bat (*Barbastella barbastella*) (Iv), (Figure 7) (Vulnerable Species - 2008 IUCN Red List), these nocturnal active mammals, uses surrounding structures as a shelter during the daytime and can be found in the study area except during the summer. Other mammals are: Blasius's Horseshoe Bat (*Rhinolophus blasii),* (Near Threatened Species- 2008 IUCN Red List), *Rhinolophus ferrumequinum*, *Pipstrellus kuhlii, Myotis blythii, Rodens:* House Mouse (*Mus musculus*), Water Vole (*Arvicola terrestris),* Red-tailed Sanderling (*Merioneslybicus*), *Allactaga williamsi,*Social Vole (*Microtus socialis*), White-toothed Shrew (*Crocidura guldenstaedti),* Hedgehogs *(Erinaceus concolor),Hemiechinus auritus.*

Figure 8 - Falco naumanni



In the project area among the main groups of birds the following species can be

observed: Short-toed Eagle (*Circaetus gallicus*), Imperial Eagle (*Aquila heliaca*), Pallid Harrier (*Circus macrourus*), migratorySaker (*Falco cherrug*), Common Kestrel (*Falco tinnunculus*), Lanner (*Falco biarmicus),* The Lesser Kestrel (*Falco naumanni*) (Ev) (Figure 8) (Internationally protected and Vulnerable Species - 2008 IUCN Red List), it is a common breeding bird in the study area (vicinity of the River and village of JeyrankechmezLittle Bustard (*Tetrax tetrax*). Migratory species include: Chukar (*Alectoris chukar),* Rock Dove *(Columba livia),* Crested Lark (*Galerida cristata*), Chough *(Pyrrhocorax pyrrhocorax).* Are typical resident species: Rooks (*Corvus frugilegus*), Jackdaws (*Corvus monedula*), Common Starlings (*Sturnus vulgaris*), Tree Sparrows (*Passer montanus*), Rose-colored Starlings (*Sturnus roseus*), Common Bee-Eaters (*Merops apiaster*), Rock Sparrows (*Petronia petronia*).

Among the main groups of Anphibians there are: Green Toad (*Bufo viridis*), Common Frog (*Rana ridibunda*), Spadefooted Toad *(Pelobates syriacus*), - Red Data Book of Azerbaijan, Common Toad (*Bufo bufo*).

Main groups of Reptil Fauna include the following species: Viper Lebetina (*Vipera lebetina),* Caucasian Agama *(Agama caucasica),* Greek Tortoise *(Testudo graeca*), European Pond Turtle (*Emys Orbicularis*) - (Near Threatened Species - IUCN 2008 Red List) Caspian Turtle (*Mauremys caspica),Lizards:Stellio caucasicus,Ablepharus pannonicus, Eremias arguta, Eumeces scheideri,Cyrtopodion caspius, Snakes:Elaphe quatourlineata, Eirenis collaris, Malpolon monspessulanus,* Grass snake (*Natrix tessellata*).

Among the main groups of fish there are: Caucasian Chub (*Leuciscus cephalus orientalis),* Kura's Barbel (*Barbus curi)*, Caucasian Bleak (*Alburnus charusini),* Bitterling (*Rhodeus sricous),*Sazan (*Cyprinus carpa),*Kura's Loach (*Nemachilus brandti).* No threatened fish species in the Azerbaijan Red Data Book are present in the rivers and streams of this region.

Main groups of insects include the following species: *Beetles: Carabus scabrosus, (*Azerbaijan Red Data Book) *Calosoma sycophanta*, (Azerbaijan Red Data Book)Butterflies:Apollo (*Parnassius Apollo)*, *Colias aurorina,Manduca atropos* Tarantula (*Lycosa*), Phalanges (*Galeodes araneoides*), Scorpions (*Buthus eupeus*), Tick (*Ornithodorus*) Darkling Beetles (Blaps), Locust (*Dociostaurus maroccanus*), Mosquito (Phlebotomus), *Megacephalus euphraticus*, (Azerbaijan Red Data Book) Alpine Swift (*Apusmelba*). (Azerbaijan Red Data Book).

Flora and Fauna of the main Borrow Pit

The Qozlucay borrow area hosts through the seasons several important species of flora (iris, tulips, cereals and bushes) and fauna (amphibians, reptiles, lizards, snakes, tortoises, birds, bats and insects) many of them are rare, both endemic and migratory species. Protected species of the Qozlucay river area includes the following plants: *Stembergia colchiciflara, Stembergia fischeriana, Rhododendron luteum, Cladochaeta candissima, Iris acutiloba, Iris reticulata, Tulipa biebersteniana, Orphys caucasica, Orphys purpurea, Achantolimon schemachense, Avena ventricosa, Stipa pellita, Calligonum bakuense, Punica granatum.* Protected species of fauna of the Qozlucay river area include bats (Chiroptera): Blasius's Horseshoe Bat (*Rhinolophus blasii),* Mehely's Horseshoe Bat (*Rhinolophus mehely*), Western barbastelle *(Barbastella barbastella*), Vormela peregusna; predatory birds like the Lesser Kestrel (*Falco naumanni*); Reptiles like the European Pond Turtle (*Emys orbicularis*) - (IUNC Red List), Greek Tortoise (*Testudo graeca*) and among the Insects: Carabus scabrosus, Calosoma sycophanta, and the butterfly species Apollo (*Parnassius Apollo*) (IUNC Red List), *Colias aurorina*, *Manduca atropos.*

4.1.2 Geology and topography

The regional geology that underlies the project area comprises principally Tertiary sediments and volcanic rocks. In many of the central and eastern lowlands, the geology is covered by various layers of alluvial deposits (sand, gravel, mud, loam) brought by the rivers and their tributaries from the erosion of the Caucasus Mountains.

As discussed in the Regional Environmental Review of June 2009, the numerous mud volcanoes within the Great Caucasus associated with subduction zones will not be affected by the construction activities. Mud volcanoes do not fall into the project area including the alignment widening and any ancillary work. The topography along the Baku – Shamakhi road features the large-flat lowland until Musguqabad with landscape of dry stepped medium-dissected sub-montane. The characteristics of this area are semi-arid and denuded terrain gently climbing towards Gubustan which lies on a hilly and mountainous area occupying the south-east part of the Caucasian ridge, at about 70 km to the west of Baku.

The irregular morphology of the interested area with hills and deep gullies shows specific visual sensibility at the presence of the road. Particular interventions will be focused to realize hiding elements such as the use of the bypasses toward Shamakhi. This region is located on the south-east side of the Great Caucasus Mountain Range, and its surface includes rolling and steeper hills. Small plateaus and low mountain ranges are located to the south of Shamakhi town. Jurassic, Cretaceous, Neogenic and Paleogenic rocks, as well as alluvial-proluvial and deluvial-proluvial depositions with shale, sandstones, and river gravels can be found in the area.

These geological structures expand from north-west to south-east and west of the Pirsaat River (including Shamakhi town). Water erosion and landslide areas are widespread in the region, as the soil is friable and easily erodible.

One of the geological-geo-morphological problems of the region is its high seismicity of the area. The area of the region corresponds to 8 score scale on the seism-tectonic map of Azerbaijan.

Hydrology

According to the water regulations of the Country, the water system in Azerbaijan (rivers, lakes) originated over a period of several geological eras is divided into two groups: 1) rivers of full-flowing regime such as Kura and Araz; 2) rivers of flood regime. Flood Rivers are the Lenkoran River and episodic rivers of the Gobustan region. This river system is changing and evolving under the influence of various physiographic factors: climate, landscape, geological structure, soil and vegetation. The most streams and rivers encountered along the project area are seasonal; the area has an annual precipitation rate of 30-40 cm. This situation will require the regulation of the water flows during construction works.

The distribution of water reserves across the region is not uniform with the consequence that these reserves do not have the capacity of meeting the constantly growing demand for fresh water.

The biggest river in the studied area is the Pirsaat Chay River which flows through the Ismailli, Shamakhi and Salyan Rayons. The Pirsaat Chay, currently used as a borrow area by multiple users, is also a source of drinking water for locals. Other tributary rivers of the Pisaat Chay, mainly formed by rain, snow, ground-water and partially by glaciers, are the Shorderesu,

Ajideresu, Zagavala Chay and Ruslar Chay Rivers. The Zagavala water reservoir located close to Shamakhi town utilizes the rivers Ruslar Chay and Zagavala Chay.

Options for water sources were investigated for the main river of Pirsaat and the groundwater associated with the lower river valley of the Pirsaat River which is the only big river around Shamakhi dominated by exposed alluvial gravels. It flows to Dzhangi village through the Gozlu river valley near the Nabur village. There is no regularity in the river regime (Figure 9). Intensive rains can, in any season of the year, cause flooding. This is mainly due to the lack of vegetation along the river course and the presence of non porous rocks in the plain area along the river course. The river dries up completely, as groundwater flows recede in the late summer/autumn periods prior to the rain and the snowmelt of the spring. At the time of the survey the river network was not wide. Of course, this is related with the dry climate of the region.

Figure 9 -Pirsaat River

Soil

Almost all the basic soil types from mountain-meadow soils of the Alpine belt to grey soils of semi-desert and desert areas and yellow-chestnut soil can be found in Azerbaijan. This diversity was favoured by geological structure, relief, hydro-climate and diversity of plant cover. The light chestnut soil on lowland at the beginning of the project road to chestnut dark and yellow chestnut soils toward Gobustan and Shamakhi region are integrated into biological processes going on hydrosphere, atmosphere and lithosphere.

Important data based on a Desktop study have shown that in the region of the east corridor is frequently possible to found bare salt-bearing formations. This is the result of transgression and regression of the western bay of the Caspian Sea, existing before the fourth age, and that is the main reason for the salinity of the soil.

In Azerbaijan, saline soils are present in many regions, mainly on steppe-like, semi desert and desert zones. In the east study corridor basic soil types are brown, gray and meadow soils in parallel with saline soils and alkali soils. Alkali soils are widely spread on plain areas of

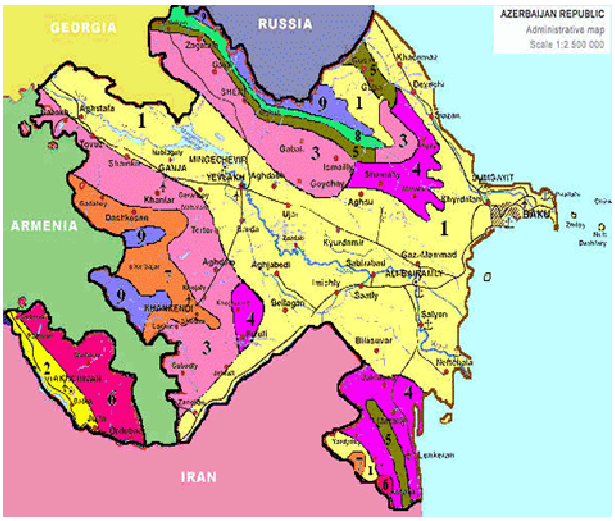
Azerbaijan, especially in the north-west of the Caspian Sea and south-east of Gobustan. This is the result of many factors such as eluvial alkalinization or the effect of ground waters, proceeding salinization.

4.1.3 Climate and Air Quality

The climate of the study area and its surrounding villages is characterized by mild-hot and semiarid weather. Winter is also mild with short and non-persistent snow with high concentration of rainfalls at the beginning of the spring/summer seasons. Summer is slightly humid and mild-hot. The temperature of the region depends on the main factors affecting the climate in Azerbaijan, namely geographical latitude and atmospheric circulation.

Taking into consideration the distribution and features of the weather, temperature, humidity, and precipitation, the area of the project can be subdivided into semi-desert and dry steppe climate which covers the east-centre lowlands and moderately warm climate with dry summer in the Gobustan-Shamakhi region.

Figure 10 -Climate Map of azerbaijan



4.2 Historical and Cultural Heritage

The main cultural settlements of the corridor Baku-Shamakhi are certainly the town of Shamakhi, also capital of the rayon with the same name, and of the historical region of Shirvan.

The town of Shamakhi is 110 km to the west of Baku and has now more than 42.000 inhabitants, 95% constituted by Azeri and Russians. In the past Shamakhi was famous for its traditional dancers, called the Shamakhi Dancers. Despite Shamakhi has suffered in the centuries from wars and earthquakes, it remains quite rich in historical and cultural monuments, among which it is worth to mention the Diri Baba Mausoleum (dated 15th century) at Zinda near the settlement of Maraza, now called, together with Narimakand, Gobustan.

In its history eleven major earthquakes have rocked Shamakhi, but each time the city was reconstructed by its inhabitants. This also thanks to its role as economic and administrative capital of Shirvan and one of the key towns on the way of the Silk Road. The only building survived to eight of the eleven earthquakes is the landmark Juma Mosque (8th century CE).

Shamakhy was an important town during the Middle Ages and was the capital of Shirvanshah state between the 8th-15th centuries and the capital of independent Shirvan Khanate, also known as khanate of Shemakha. In the middle of the 16th century the city hosted an English commercial factory.

Until the devastating earthquake of 1859, Shamakhi was the capital of the Shamakhi Governorate of the Russian Empire. From 1859, when the capital of the province was transferred to Baku, the importance of the city declined.

Nowadays Shamakhi encompasses approximately 50 municipalities. As a centre of an agricultural region (fruit, grapes, potatoes, wheat and livestock farming) Shamakhi is a centre of important agro-food industries that together with carpet and electronics factories and touristic and transport services make complete the picture of its economic potential. Moreover an automobile assemble company (Azsamand) is producing in the area motor vehicles under Peugeot license.

The Gobustan rayon is predominantly agriculture oriented with cattle breeding and wine growing activities, with some touristic attraction and commercial structure recently established.

At Pirsat Pir near Sabir there is place where the local people meet to drink holy water.

Along all the road from Dzhangi to Shamakhi it is quite usual to find butchers selling lamb meat and restaurants that along with vegetable and fruit shops are the base of the commerce of the area, and represents also a tradition of the Azeri gastronomy very appreciated by the tourists coming from the capital. It must be noted that the access conditions of some of this activities along the road are also cause of many accidents and that therefore a better planned location should be identified through local urban and commercial planning for the interested communities.

4.3 Socio Economic Background of the project area

Undoubtedly the enlargement of the Baku – Shamakhi Road will boost the development opportunities of the entire corridor, especially in the Maraza- Narimankand area and in Shamakhi – Sabir urban settlements.

The benefits deriving from the enlargement will positively influence also the villages and rural settlements nearby the road alignment, increasing the job occupancy, both during the construction period and the operational phase. The rate of job occupancy in the region is generally in line with the national average (*48%) while it must be noted that, according to the survey carried out in December 2011 and in January 2012, the Shamakhi Rayon lies well over that figure and in the villages of Gobustan Rayon occupancy rates are below the national average. (More details are shown in the Annex 4).

Rayon/Area	Population Total	Employed		Unemployed	
		Number	%	Number	%
Dzhangi	300	151	50	115	38
Gobustan (Narimakand+ Maraza)	7.965	3.986	50	2.916	37
Gobustan (other villages)	12.310	4.298	35	5.388	44
Shamakhi (Sabir+Shahtyar)	42.135	23.591	56	14.142	34
Shamakhi (other villages)	17.860	10.221	57	5.856	33
Total	**80.570**	**42.247**	**52**	**28.417**	**33**

*National Occupancy Rate 48%

That is the reason why the entire territory around Shamakhi- Sabir and Maraza – Narimankand (now Gobustan) requires an intense Territorial Development Plan to support the local urban community to develop new industrial and commercial settlements as well as a better regional agro food market and logistic platform, both for passenger and goods.

A territorial development plan is also envisaged for the localization of some commercial activities close to the main road junctions connecting it to the minor/local road. This will increase the road safety together with the improvement of the accessibility to and from the minor settlements, allowing a reorganization of the framework of public and private services such as the police station and patrols, health care centres, schools, shops, agriculture and veterinary services, road assistance, bus and petrol stations.

Furthermore it is strongly recommended, especially for the existing Hotels, restaurants and Cafes activities, a reorganization of their presence and/or localization on the territory, taking also into account a predictable increase of the mobility due to the better accessibility and an expected deep modification of the economic structure of the concerned Rayons.

As a consequence also the infra-village relationships and road connections will increase job opportunities especially in the agro-food sector such as the dairy and livestock farming (other than the viticulture and fruit culture). This will allow the localization of new and better organized cheese factories and more hygienic butcheries, which will improve the local production (nowadays mainly consumed on a local basis) in the urban areas and especially on the capital market of Baku. The touristic sector will also benefit of the enlargement of the Baku – Shamakhi road due to the reduction of the time required to travel from the capital Baku to the main touristic destinations (Pirgulu Mountains and surrounding villages). This project will also allow others villages and settlements to enter the touristic sector offering better services based on the quality rather than on price and quantity. The increase of new and more qualified jobs for the local population and opportunities for the women, young and the literate professionals, now obliged to move to the capital to find appropriate employment, will significantly contribute to the local development.

It is also envisaged a reorganization of the local services to enable the employment of more qualified personnel in all the sector of the public administration and especially in the building and environment sector , in the health care and educational services, in the safety activities as well in the local economic development.

4.4 Borrow-pits Area

Close to the project area there are many borrowing areas. In general river extraction is one of the most used ways to produce good quality aggregates in Azerbaijan.

Due to the prevailing environmental conditions, rivers used for materials extraction have a bimodal character:

- almost dry and only single events of high precipitation occur
- not particularly significant seasonal variations in river hydrology occur.

For most of the year the water flow in most small and medium size rivers is very low and extraction is carried out in the largest part of the dry river beds that commonly includes material from sand to large boulders. In spring time the water flow increases and the active river terrace is flooded and part or all of the extracted material is replenished; excavation operations then commonly shift to adjacent old river terraces, if available.

The most suitable sites for supplying aggregates to the project are the river that flows through the city of Shamakhi (Pirsaat river) and the Qozlucay borrow area. The first site presented multiple extraction plants in a state of apparent distress and absence of protection of the river bed, thus it does not present particular criticisms. On the contrary, despite the extraction activity the second area (Qozlucay), is not inhabited and presents a high environmental value. Therefore it deserves environmental protection measures for the species that live in the area (see the list at par. 4.1.1, subtitle Flora and Fauna of the main Borrow Pits). However sensitive ecosystems were not present everywhere at the time of the survey.

River extraction activities may imply several environmental and socio-cultural impacts. These potential impacts can be very different and depend on the methodology used by the contractor for the extraction. Therefore a thorough evaluation of the consequences of the use of borrow pits can be done only when the contractor has developed his plan for the extraction. At that stage the presence of a National Ecologist on site will help to ensure the implementation of appropriate mitigation measures.

In such a situation it is important to pay particular attention and "due diligence" to environment and social sustainability aspects of the extraction process in the borrow areas for the entire duration of the construction. This is especially true with reference to water pumping. The impact on the quality of superficial water of construction works might result in sedimentation and construction waste-water runoff into the river. The consequent large sediment load discharged into the river will impact the chemical and ecological balance of the river compromising the drinkableness of water for the locals. Finally, of course, an excessive extraction of water may affect the water level.

The social acceptability depends also on the possibility of re-utilization of the excavated areas and borrow pits for public interest, e.g. artificial lakes, landscape improvement, storm water collection, etc. A good re-utilization plan usually makes local communities more inclined to accept the temporary negative impacts of this kind of activities. Obviously re-utilization decisions are taken at a higher level in compliance with political strategies and budget plans.

In conclusion, as long as the main environmental, socio-cultural and health concerns are addressed, no structures are put in danger, the resource is fully replenished and the activities are in general properly managed (see EMP2 – Borrow Pit Management Plan), the extraction of materials for the project from the two above mentioned borrow pits is deemed acceptable.

4.4.1 Guidelines for Contractor's extraction plans

The following guidelines include recommendations and documents that should be included as a minimum in the plans prepared by the Contractor for an efficient and environmental friendly

use of borrow pits.

1. Survey of the state of fact of the area of intervention

Before to start any activity, a complete survey of the project area has to be carried out in order to record its original horizontal and vertical alignments. The number of surveyed points will be not less than 50 points per hectare for regular/plain surfaces and not less than 100 points for irregular or particularly sloped surfaces. Specifically the survey will:

- Include all the areas directly or indirectly affected by the project;
- Include all the areas connected to the intervention such as:
  - Buffer zones,
  - Degraded areas to be recovered,
  - Connection areas,
  - Buildings, power lines, roads, rivers, underground lines (water, gas, sewerages, etc.), property lines (cadastral data), etc.

All the elements requiring a certain buffer zone from the area of intervention will be accurately measured and located on the maps. Such elements will include inter alia:

- Footprint of buildings,
- Foundation of pylons,
- Centerline of road ditches,
- Maximum water level of watercourses
- Any other structure falling under this category.

The survey shall be connected to a system of datum points and shall be performed using techniques and equipment so to ensure accuracy not less than 0.10 m for the coordinates of the surveyed points.
The outcome of the survey shall allow the extrapolation of a tridimensional model of the area in which any variation of the terrain, both in plan and in altitude, bigger than 0,50 m is appraisable.

2. Exploitation Plan

The plan shall consist of a report and a set of drawings including the following.
Report:

- Overall duration of the intervention and implementation plan;
- Estimation of material to be excavated showing different values for pedogenesis soil and for spoil materials;
- Slope stability calculation for excavated surfaces and for other surfaces permanently or temporary affected by the intervention and/or to be neglected after or during the extraction works;
- Plan for handling different materials with the identification of stockpiling areas, loading yards and internal routes;
- Evaluation of type and number of machineries and means of transportation with

the indication of average and peak traffic values, impact on public roads and identification of public roads affected by the traffic generated by the exploitation of the area;
- Indication of types of material expected to be found in the area (aggregates for cement and bituminous conglomerates, backfilling material, etc.) and their destinations (batch plants, work-site, storage areas, etc.);
- Description of new plants to be installed (if any) in terms of dimensions, capacity, their impact on the environment and water resources;
- Establishment of environmental monitoring procedures to be implemented in accordance with the applicable standards.

Drawings:
- Cadastral plans showing property boundaries and areas, buildings, rights of way, historical routes, etc. (even if not reported in the official maps);
- Representation of horizontal and vertical alignments of the state of fact of the area affected by the intervention and surrounding areas including but not limited to roads, buildings, service networks, ancillary works, water wells.
- Identification of areas with different functions within the boundary of the intervention, of compartments and of the geometries of excavation;
- Longitudinal and cross sections in a proper scale in relation to the plans and using the same scale for horizontal and vertical dimensions. Sections will show the state of fact and the maximum exploitation conditions, highlighting the most sloped excavation lines as much as possible;
- Details of works to protect the soil and control the superficial water flowing to be executed before or during the intervention, of infrastructures and facilities, of connection to public roads and networks, of new plants if required and of the mitigation measures to implement for the identified environmental impacts;
- Maps (1:10.000 – 1:25.000) of roads to be used by heavy trucks for the transportation of excavated materials;
- Axonometric projection or tridimensional model of the area and its surroundings (recommended for hilly/mountainous areas).

3. Resettlement Plan

The plan shall consist of a report and a set of drawings including the following.
Report:
- Identification in terms of performances of the objective of the optimum and achievable environmental quality for the area after the intervention on the basis of a thorough analysis taking into account morphology, climate, soil, vegetation, wildlife and urban planning.

In relation to the identified objectives the following shall be provided:
- Considerations on morphological remodeling and settlement;
- Identification of adopted solutions to ensure the stability of the area and its inclusion on the landscape;

- Earthworks balance and indications on quality and origin of materials to introduce in the area (if necessary);
- Slope stability verifications for final surfaces by the use of appropriate models in relation to the actual lithology and lying of the affected soil;
- Description of measures to prevent landslides and erosion and of works to execute to avoid the clouding of the natural water courses and to control the superficial water flows;
- Description of procedures concerning the vegetation in order to ensure the bio-diversity of the area, the sprouting of the recommended species and their flourishing and development;
- Description of the works to execute to allow the use of the area by the people, including forecasts and recommendations on the refurbishment/demolition of buildings, plants and other infrastructures used for the extraction activity but not compatible with future utilizations of the area.

Drawings:

- Final morphological layout of the area, drawn on the basis of the above mentioned survey and at the same scale as the Exploitation Plan, including:
  - Backfilled areas;
  - Areas characterized by the presence of the original substratum;
  - Final functional destinations;
  - Works to execute to ensure the permanent stability of the area;
  - Works to execute to ensure a proper control of superficial water flows;
  - Buildings (if any);
  - Structures to refurbish/demolish according to the future utilization of the area.
- Detailed vegetation and re-naturalization plans;
- Longitudinal and cross sections showing both the surfaces of maximum exploitation and of final resettlement drawn in such a way to show the slope of excavation surfaces as much as possible;
- Detailed design of the permanent works for environmental protection and control of superficial water flows, of the infrastructures to build for the reutilization of the area and of the replanting plan.

4. <u>Topographical monitoring of horizontal and vertical alignments</u>

The whole area affected by the extraction activity shall be provided with minimum three datum points permanently fixed to the soil and installed in such a way:

- To ensure the reliability of the point until the completion of the works. This includes the stability of the structure on which the datum point is fixed;
- To allow a clear visibility between two consecutive datum points;
- That the distance between two consecutive datum points is not longer than 1000 m;

- To be always accessible. Enclosed/fenced areas or other locations not accessible without the permissions of people not involved in the extraction activities shall be avoided;
- To allow survey operations. For such reason an appropriate area around the datum point will be kept free from materials, equipment or any other object.

For each datum point an identification table will be prepared showing the following:

- The identification number of the datum point as it is shown on the identification tag of the point;
- The description of the structure on which the datum point is installed;
- Topographical map (scale 1:5000) showing the position of the datum point;
- A picture of the datum point;
- Coordinates of the point referred to at least one national datum point clearly identifiable and located outside the area of intervention.

4.5 The critical Areas

4.5.1 Social, urban & safety issues

Alternative alignments have been studied by Scott-Wilson designers to avoid as far as possible the crossing of the urban areas of the main settlements along the corridor. Those urban areas from the safety point of view can be considered "critical areas". They include:

- Dzhangi from km 45+800 to 47+600
- Narimankand-Maraza (now Gobustan) from km 76+500 to 82+500
- Sabir from km 103+200 to 106+000

The enlargement of the road inside those "city centres" can probably break the urban set-up reached in the last 10-20 years. With the aim of minimizing the consequence of these crossing, particular measures have to be provided to avoid road accidents and increase road safety.

The final decision about if and where to build by-passes is addressed in the design. Here, according to the recommendations included in this EIA as well as other recommendations coming from the Client, the best solution for each specific situation has been applied.

Of course by-passes will have to consider budget and environmental constraints and have been designed only for those sections of the Baku-Shamaki corridor where they were absolutely necessary (landslide or prone to landslide areas in which alternative engineering mitigation measures are not sufficient to minimize the risks coming from the road enlargement).

With specific reference to the mentioned villages, the following has been noticed during the development of this report.

In **Dzhangy** there is not a real by-pass. For the new road in the direction towards Baku the existing alignment were confirmed, while in the opposite direction (towards Shamakhi) the carriageway has been moved from the existing alignment so to avoid to cross an area at risk of erosion. The separation of the two carriageways prevents expensive consolidation works and reduces the impact of the road on the environment.

For the two villages of **Narimakand** and **Maraza** (now Gobustan) the realization of a by-pass is strongly recommended because the dense urbanization of the area and a difference in height on the East side of the alignment will be an obstacle to the widening of the road.

Concerning **Sabir**, our team was informed about the decision of not having a by-pass for this village due to financial restrictions. Therefore the environmental consultant recommended the implementation of traffic mitigation measures (traffic calming, speed limits, roundabouts, etc.).

Finally, it is worth to mention that the construction of bypasses can without consequences be postponed to the next years when the local urban development and the population increase will be better defined and completed by a sound and appropriate urban planning design.

4.5.2 Flora, fauna and livestock issues aspects

From km 54+000 to km 57+800

- The section is characterized on both sides by almost continuous presence of a young reforestation (State Forest Found, SFF - year 2003) with trees about 1-2 meters high including mainly coniferous and deciduous species. It is suggested to apply in particular the recommendations and mitigation measures listed in paragraph 7.1 subsection 'Material Extractions' titled 'Dust Emissions', 'Land Conversion' and 'Stormwater Resource Protection' with a replanting plan supported by an Environmental Monitoring Program.
  The recommended proportion between the numbers of replanted trees vs. cut trees is 5:1.
- The involvement of national ecologist during the construction is suggested to ensure that particular care is used for trees that will have to be uprooted and in general for the implementation of the above mentioned recommendations and plans.

At km 58+000

- At this location has been noted the presence of livestock (Figure 11) and farms. We recommend the application of the mitigation measures listed at paragraph 7.1, and not least as a very important safety factor, the fencing on both sides of the road to keep animals out of the way. Being barriers an obstacle to migration of the wildlife mitigation measures are recommended (e.g. underpasses) in order to reduce potential ecological impacts such as the habitat fragmentation.

Figure 11 -livestock

From km 61+000 to km 62+000

- The section is characterized on both sides by the presence of recent reforestation (State Forest Found, SFF) with trees about 1-2 meters high including coniferous and deciduous

species. It is suggested the application in particular the recommendations and mitigation measures listed in paragraph 7.1 subsection 'Material Extractions' titled 'Dust Emissions' and 'Land Conversion' in addition to natural reintegration of uprooted trees.

From km 63+000 to km 64+700

- The section is characterized on both sides by the presence of a recent reforestation (State Forest Found, SFF) with trees about 1-2 meters high including coniferous and deciduous species. It is suggested the application of the recommendations and mitigation measures listed at paragraph 7.1. Planting plans should be supported by the implementation of an Environmental Monitoring Program with the involvement of national ecologist to be present on site during construction activities. Particular care should be used for trees that will have to be uprooted and in general for the implementation of the above mentioned recommendations and plans.

At km 73+000 (existing bridge no.2)

- The bridge (Figure 12) is within the nesting area (Figure 13) of Lesser Kestrel (*Falco naumanni*) (Figure 8), an internationally protected and vulnerable species. The Kestrel is present in the area around Jeyrankechmez River and nests under the two adjacent bridges (at km 73 and km 80). In order to minimize the impact of the construction on the birds' life it would be advisable to avoid any work during the nesting season of the species (indicatively from April to August) at the identified sites (existing bridges n. 2 and 3 over the Jeyrankechmez River) and in the surrounding areas (home-range of the species). It is also required the careful identification of the location of the work sites and the route of heavy vehicles to consider their impacts on the Kestrel during the same period. Specific recommendations and mitigation measures are listed at paragraph 7.1. Such measures take into account also the impact of the construction on the quality of the water as result of sediment and construction waste runoff into the river which can even affect the water levels. Among the same recommendations it is included the presence on site of a National Ecologist, especially during the implementation of construction activities to be carried out in the above mentioned nesting period.

Figure 12 -bridge no.2

Figure 13 - nest

At km 74+000

- The section is characterized on the right side by the presence of erosion and landslides. It is suggested to apply in particular the recommendations and mitigation measures listed in paragraph 7.1 subsection 'Material Extraction' titled 'Hydrology' and 'Stormwater Resource Protection' and 'Groundwater Resource Protection'.
  At the same chainage there is a grazing area for livestock, therefore, it is recommended to implement the mitigation measures listed in paragraph 7.1, envisaging fencing on both sides of the road. This will keep animals out of the way, while the construction of underpasses will avoid high potential ecological impacts due to the fragmentation of the natural habitat. The barriers will prevent uncontrolled migration and crossing of wild animals during the construction and will force the animals to use underpasses during the operational phase creating new safe routes.

From km 76+000 to 77+000

- At this location it was noticed the presence of livestock and farms on the right side of the road. Again we recommend the mitigation measures listed at paragraph 7.1 and road fencing.

At km 79+000 (existing bridge no.3)

- Like the bridge no. 2, the bridge n°3 (Figure 14) is within the nesting area of Lesser Kestrel (*Falco naumanni*). Therefore we recommend applying the same prevention and mitigation measures suggested for the bridge no. 2 at the previous page.

Figure 14- bridge n.3

From km 92+000 to km 95+000

- The section is at the end of Gobustan Rayon. It is characterized by heavy and mature reforestation (SFF) on both the left and right side of the road, including coniferous and deciduous trees. It is suggested to apply the recommendations and mitigation measures listed at paragraph 7.1 subsection 'Material Extractions' title 'Dust Emissions' and 'Land Conversion' in addition to natural reintegration of uprooted trees. Like already said for other locations a replanting plan supported by the implementation of an Environmental Monitoring Program with the involvement of national ecologist during the construction are recommended.

From km 101+000 to km 103+000 and km 105+000

- The section is at the end of Gobustan Rajon, is characterized by an heavy and mature reforestation (SFF) on the left and right side, composed of coniferous and deciduous trees.

It is suggested to apply in particular the recommendations and mitigation measures listed in paragraph 7.1 subsection 'Material Extractions' titled 'Dust Emissions' and 'Land Conversion' in addition to natural reintegration of uprooted trees, with a replanting plan supported by an Environmental Monitoring Program with the involvement of national experts.

At km 106+700

- The site is characterized on the left side by the presence of clear landslides. It is suggested to apply the recommendations and mitigation measures listed in paragraph 7.1 subsection 'Material Extraction' titled 'Hydrology' and 'Stormwater Resource Protection' as the stability of the slopes could be compromised during extraction activities.
  At the same location it has been noticed on the right side, on the bottom of the valley, the presence of livestock and large farms, therefore we recommend the implementation of the mitigation measures listed at paragraph 7.1 and also, as a very important safety factor, the fencing on both sides of the roads to keep animals out.

At km 107+000 (Acideresu bridge)

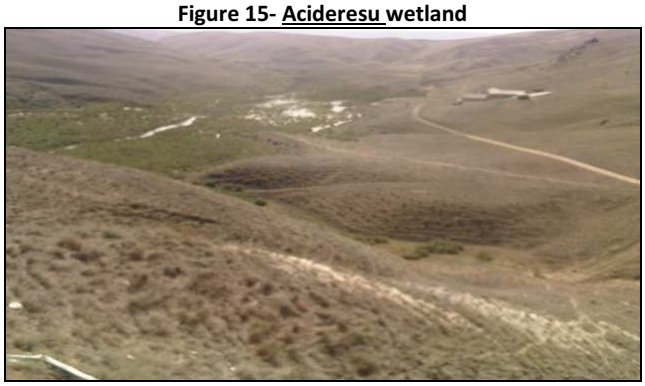
- The Acideresu wetland is a seasonal (temporary) accumulation of water (probably due to the presence of human activities in the surrounding areas) generated by the water of the Acidersu River and located in proximity (downstream) of the Acideresu Bridge. This wetland represents a supply of water for livestock in the area and allows the formation of a series of rare ecological niches and trophic chains for amphibians, reptiles, birds, fishes and mammals. Being the area characterized by long periods of drought such a fragile ecosystem requires protection and the application of appropriate prevention and mitigation measures in order to avoid negative impacts of construction activities. Specific recommendations and mitigation measures to be adopted for the Acideresu bridge are listed at paragraph 7.1 and include, among the others, the following:

  - The washing of any concrete mixing plant or ready mix lorry should be carried out in such a way to prevent the effluent to flow into natural watercourses or drains;
  - Before that any discharge of water is made from the site, adequate provisions should be made to ensure that it is not polluting. Techniques may include sedimentation ponds, the use of straw bales for silt trapping and the use of flocculants;
  - The placing of any wet concrete in or close to any watercourse should be controlled to prevent the risk of leakage of wet cement into the watercourse;
  - Where water would need to be removed from excavations, it should be transferred to the minimum achievable distance to the discharge;
  - All pumped drainage from the construction works including areas used for temporary storage of construction materials or excavated soils, should be passed through silt settlement treatment prior to discharge to surface watercourses or drains; silt settlement treatments may, for example, include straw bales, grassland soak away, silt sedimentation ponds;
  - Storage compounds for the storage of construction materials or temporary stockpiling of excavated soils should be located away from superficial watercourses and drains;

- All roads and hard-standing should be kept clean and tidy to prevent the build up of oil and dirt that may be washed into a watercourse or drain during heavy rainfall;
- Where appropriate, watercourses should be bund to prevent contamination from surface water runoff;
- The use of water sprays to reduce dust or to wash down construction areas should be carefully regulated to avoid washing substantial quantities of silt etc. into surface water drains. Where large quantities of gravel, mud or other similar material required clearing, the area should be swept clean prior to any subsequent hosing down;
- Concreting at watercourse culvert sites should be closely supervised to prevent concrete contamination of the watercourses;
- Subsoil should be exposed for a minimum length of time after topsoil strip. Cut-off trenches, where necessary, should be excavated to prevent massive surface water run-off into watercourses. Cut-off trenches should discharge into sedimentation ponds;
- Topsoil/vegetation along watercourses should be retained to aid attenuation and sediment infiltration.
- Where possible, existing trees and vegetation groups should be retained and protected;
- Where protected plant species occur adjacent to the construction compounds or working areas, these areas should be clearly marked to avoid disturbance by machinery associated with construction;
- Storage compounds for fuels, oils or other liquid chemicals should be located away from surface water drains;
- Drums and barrel should be stored in a designated bund safe area within the site compound and should be fitted with flow control taps;
- Small plants, such as pumps, should be equipped with drip trays;
- Spill kits should be located on sites near to watercourses and within the works compounds and staff should be trained for their use;
- In order to prevent water pollution resulting from worker-generated sewage effluents, portable toilets should be provided or alternatively existing toilet facilities at a convenient location for construction workers' use;
- Emergency response procedures should be included to handle leakages or spillages of potentially contaminating substances.

Finally, the presence on site of a National Ecologist is recommended during construction activities in critical areas in order to ensure the proper implementation of these measures.

Figure 15- Acideresu wetland



At km 111+000

- The section is characterized by heavy and mature reforestation (SFF) on the left and right side, including coniferous and deciduous trees. It is suggested to apply in particular the recommendations and mitigation measures listed in paragraph 7.1 subsection 'Material Extractions' titled 'Dust Emissions' and 'Land Conversion' in addition to a replanting plan supported by the Environment Monitoring Program with the involvement of national ecologist to supervise related activities.

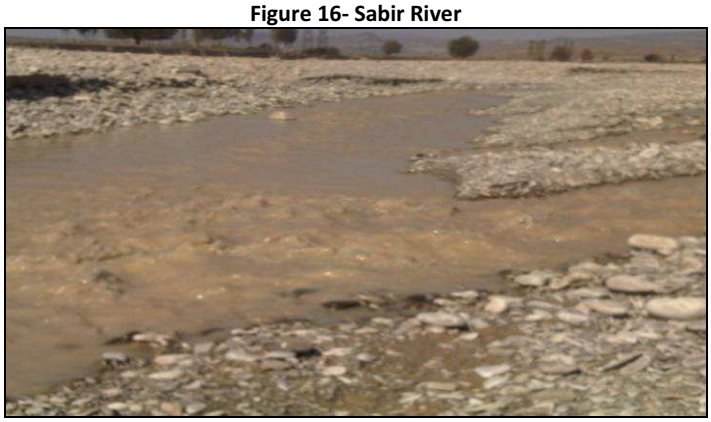
At km 112+000

- Natural borrow pits to provide suitable material for the construction works have been found along the Sabir River. The areas have been investigated and selected as suitable sources of aggregates and backfilling material (due to the characteristics of the soil). The construction Contractor (having obtained the state and local permits for the use of borrow pits) will notify in advance the Engineer the intention to open new borrow pits or to use existing ones for the project. At the same time the Contractor will have to prepare a detailed plan for extraction of materials from the identified borrow pits. This plan will ensure that the proper mitigation of the impact of the extraction activity on the local environment/population. As a minimum the plan will include:
    a) estimate of resources to be extracted;
    b) stockpiling location;
    c) adequate room for all activities;
    d) water management structures;
    e) site operating procedures

  The developed plan should also include monitoring and reclamation procedures with all related provisions such as overburden replacement for site grading and reshaping to the original topography, etc.

  Of course, all the recommendations and mitigation measures listed at paragraph 7.1 remain valid and should be included in the plan. Moreover the involvement of a national expert to be present on site during the use of the borrow pits in order to ensure the implementation of the plan is recommended.

Figure 16- Sabir River



At km 116+000

- The section is characterized by mature reforestation (SFF) on both sides, including coniferous and deciduous trees. It is suggested to apply in particular the recommendations and mitigation measures listed in paragraph 7.1 subsection 'Material Extractions' titled 'Dust Emissions' and 'Land Conversion' in addition to a replanting plan to be supervised during its implementation by a national expert.

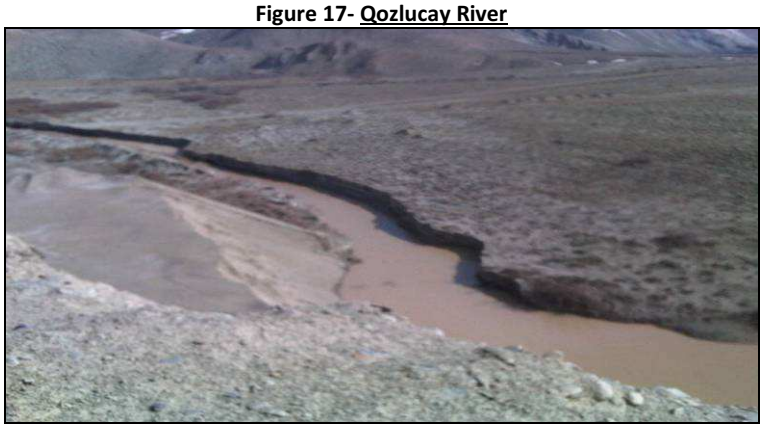
Borrow Pit of Qozlucay River

- Regarding the borrow pit at Qozlucay river (Figure 17) considering the high amount of aggregates to be extracted the main concern is about the washing operations. The Contractor will have to develop a sustainable 'Water Supply Management Plan' to avoid or minimize downstream impacts to the fragile natural aquatic ecosystems in accordance with the EHS Guideline for 'Construction Material Extraction' - Performance Indicators and Monitoring. Besides the recommendations included in this report it is suggested the presence on site of a National Ecologist during construction activities to ensure the implementation of proper safeguard measures for sensitive species, with particular attention to reptiles (turtles) and mammals (bats), including:

  a) Western Barbastelle Bat (*Barbastella barbastella*) (Vulnerable Species -2008 IUCN Red List)
  b) Spadefooted Toad *(Pelobates syriacus*), - (Red Data Book of Azerbaijan)
  c) European Pond Turtle (*Emys Orbicularis*) - (Near Threatened Species - IUCN 2008 Red List)
  d) Caucasian Chub (Leuciscus cephalus orientalis)
  e) Kura's Barbel (*Barbus curi)*
  f) Caucasian Bleak (Alburnus charusini)
  g) Bitterling (Rhodeus sricous)
  h) Sazan (Cyprinus carpa)
  i) Kura's Loach (Nemachilus brandti).

These species are not identified as threatened species in the Azerbaijan Red Book but they are an integral part of the fragile food chain of the majority of other endangered species.

Figure 17- Qozlucay River



In relation to the strong pumping water from underground sources, as per the above observation, we recommend the application of all the recommendations and mitigation measures listed in paragraph 7.1 with the support of a national expert.

4.5.3 Geological aspects

The study area is located in large open landscape between Gobustan and Shamakhi which during recent years has been mapped by local and international Consultants. The geotechnical/geological scenario of the area is quite complex and from the technical point of view it is characterized by general instability and it is sensitive to erosion under weather conditions.

The visual in-situ assessment of the soil conditions along the road alignment has identified both processes of erosion and landslide. These processes are influenced by many factors that can be grouped in different classes.

A critical area (coordinates 40º 29' N,49º 14' E) at altitude 484 m a.s.l. is shown in Figure 18, where rills/gullies may be caused, at least partially, by the continuous sliding from above areas. This has to be taken into account during design.

Figure 18- Large rills/gullies on an eroding hill slope

Figure 19- Flow-slide at Ch. 105+000

A thorough evaluation of the catchment of a rill will be possible only after further site inspections, in different periods of the year, by examining the evidence of flow lines of water

to determine the shape and size of the boundary of the affected area. Also, diversion structures may be used to reduce the volume of flow over a bare slope, and surface roughening techniques to reduce the slope length of the surface by breaking up sliding layers.

The slope as seen in Figure 19 with moderate lateral erosion and falling of relatively medium amount of earth material that was considered to be stable under natural conditions may become unstable if adequate engineering practices were ignored.

In case that a slope is to be stabilized to eliminate possible flow-slide, the surface layers should be stripped and replaced with dry and well compacted fill. A drainage system is also required between old and re-compacted fill to prevent development of water pressure behind the filled zone.

The operation of re-profiling a slope with the aim of improving its stability can be achieved through geometry modification. This includes various procedures such as lowering the slope, filling its foot and after geotechnical investigations, providing suitable retaining structures, if necessary.

Figure 20- Ch. 108+000

Widening of the existing road by cutting, requires temporary stabilization and afterwards reinforced fill embankment, also conditioning surface drainage channel to convey surface runoff down across the land and improving the slope profile by forming benches, and also protection and treatment to earth-filled slope.

A preliminary study has been conducted for determination and monitoring of the current landslides boundary along the alignment between Km 103 and Km 111. In this section the soil is particularly subject to erosion being predominant fine-medium cohesion-less silty sand with irregular gravel particles. Some samples have been taken to determinate the physical and mechanical properties of the materials. The outcomes of this survey show that the soils of the sliding mass can be classified as gravelly sand to clayey silt and silty clay with medium to high level of plasticity and low-medium natural moisture content and medium porosity.

During the design stage further analysis and laboratory tests (e.g. hydrometer analyses, Atterberg limit determination, water content determination, crumb dispersion test, permeability determination, consolidated and unconsolidated undrained tri-axial compression test) have made the designer able to provide specific solutions for these areas such as retaining walls, geo-textiles, etc.

4.5.4 Air and Noise aspects

As regards noise and air pollution the identification of critical points was the objective of a specific survey that was carried out by local personnel specifically trained for this task. For this purpose a "corridor" or "strip" of 250 m of width on both sides of the centreline of the existing alignment was defined in order to collect information about land use and sensitive areas (geographical position and characteristics).

The critical points listed in the next table were identified (5 schools, 4 mosques, 1 museum and 4 cemeteries).

Table 3 – Sensitive sites located along the road

Sensitive Sites	Locations	Chainage (Km)	Distance from carriageway (m)
Schools	Dzhangi	46+750	245
	Narimankand	78+900	250
	Narimankand	80+320	150
	Sabir	103+360	50
	Shamaki	110+700	60
Mosques	Dzhangi	48+100	30
	Narimankand	79+320	25
	Sabir	103+000	220
	Sabir	104+450	100
Museums	Shamaki	109+600	60
Cemeteries	Narimankand	80+150	180
	Sabir	104+000	20
	Shamaki	110+450	80
	Shamaki	111+500	10

Of course, besides the sensitive sites above listed, all urban and suburban areas are also sensitive to the effects of the new road. Such areas are highlighted in the next pictures.

Figure 21- Urban areas along the road (km 45+000 – 70+000)

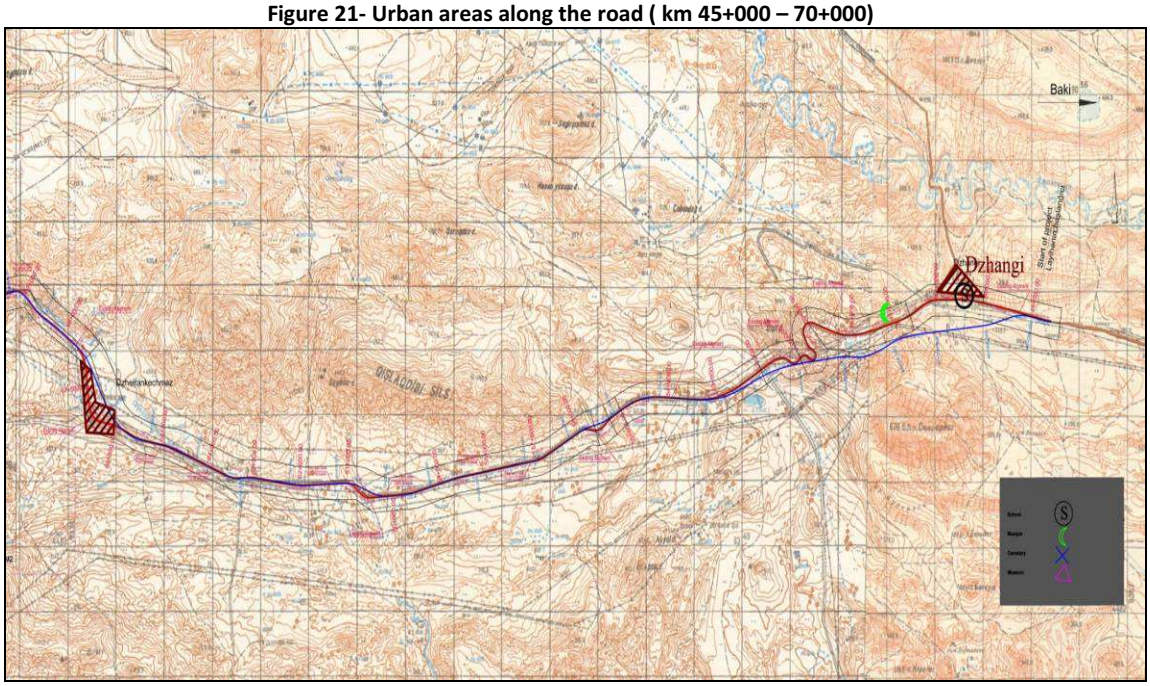


Figure 22- Urban areas along the road (km 70+000 – 90+000)

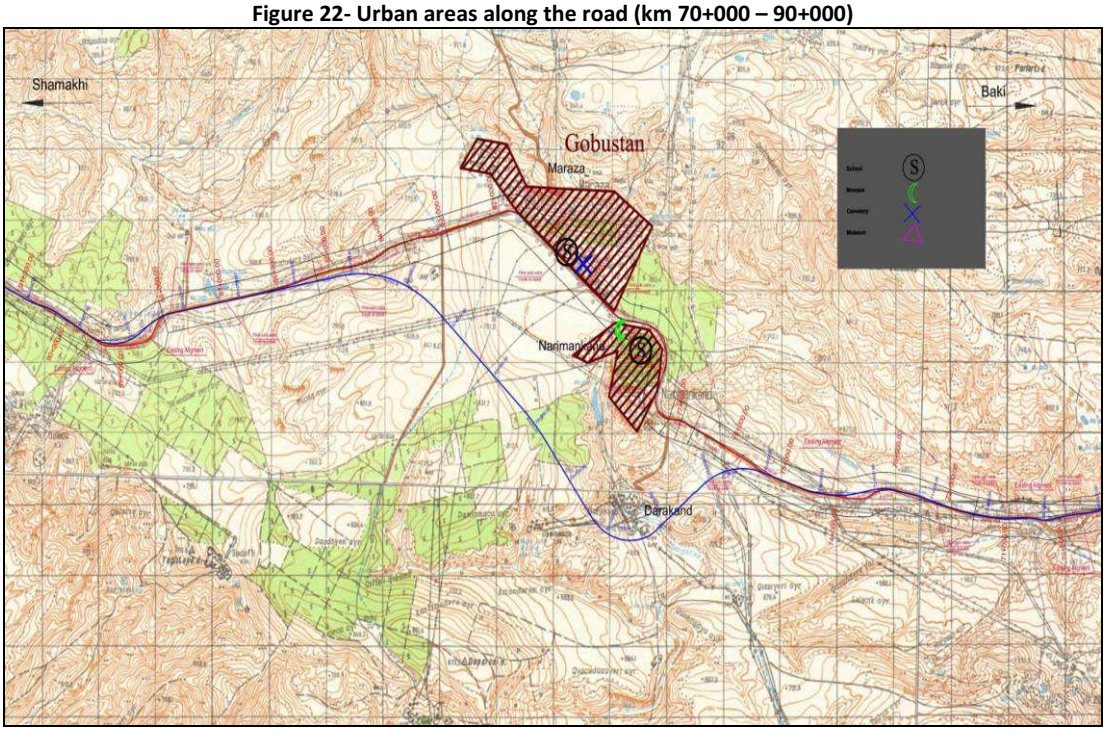
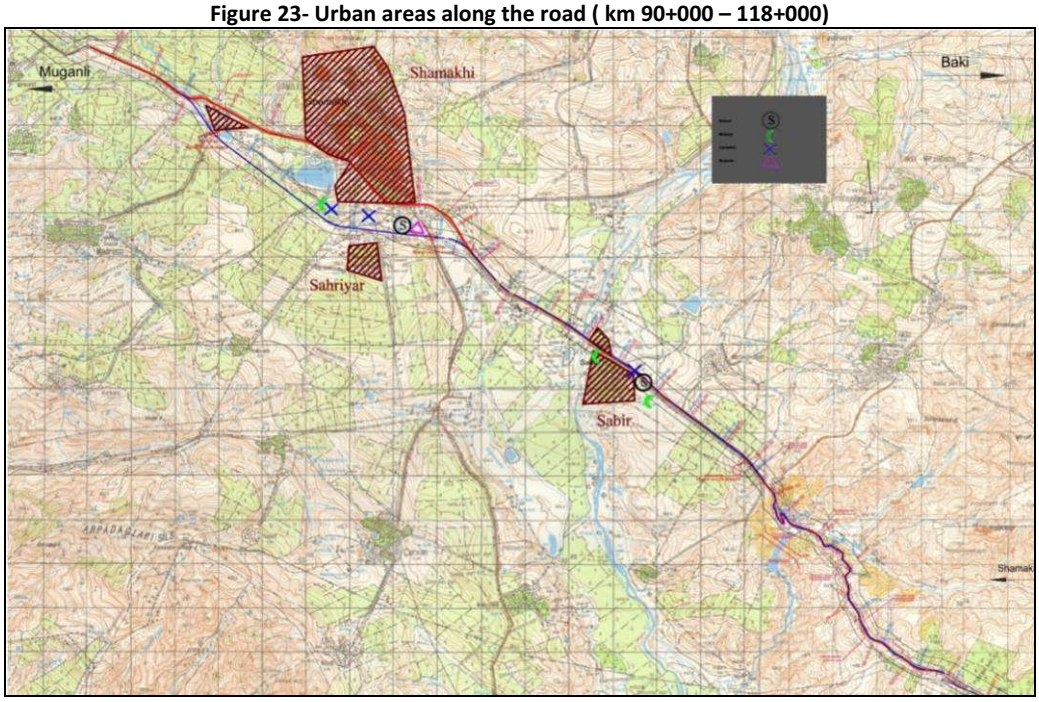


Figure 23- Urban areas along the road (km 90+000 – 118+000)



As a matter of fact, the most of the alignment crosses semi-desert or rural areas, with no main industrial activities. Villages and towns crossed by the road are mainly based on rural activities, with a few industrial activities usually associated to the processing of agricultural products (like wine production in Shamaki and its surroundings). Thus, it is possible to say that in general the local environment has a very small impact on noise and air pollution.

5 ENVIRONMENT IMPACTS FORECAST

5.1 Effects during Construction Period

5.1.1 Biological aspects

ROADS IMPACTS

Road Construction

Construction activities along a road alignment may adversely affect wildlife habitats, depending on the characteristics of existing vegetation, topographic features, and waterways. Examples of habitat alterations coming from these activities, including fragmentation of forested habitat, can be found in the first section from km 45+00 to 67+500 where potential loss of nesting sites of listed rare, threatened, or endangered species and/or high biodiversity/sensitive habitat exists. Disruption of watercourses, creation of barriers to wildlife movement; and visual and auditory disturbance due to the presence of machinery, construction workers, and associated equipment can be also potentially adverse if not managed in a proper manner due to the presence for example of the Falco Naumanni, Western Barbastelle Bat. In addition, sediment and erosion from construction activities and stormwater runoff may increase turbidity of surface waters.

Storm water

Construction or widening of sealed roads increases the amount of impermeable surface areas, which increases the amount of superficial water runoff. High stormwater flow rates can lead to stream erosion and flooding. Stormwater may be contaminated by oil and grease, metals (e.g. lead, zinc, copper, cadmium, chromium, and nickel), particulate substances and other pollutants released by vehicles on the roadway, in addition to de-icing salts (e.g. sodium chloride and magnesium chloride) and their substitutes (e.g. calcium magnesium acetate and potassium acetate) from road maintenance facilities in cold climates. Stormwater may also contain nutrients and herbicides used for management of vegetation along the road.

Waste

Solid waste may be generated during construction and maintenance of roads and associated structures. Significant quantities of rock and soil materials may be generated from earth moving during construction activities. Solid waste generation during operation and maintenance activities may include road resurfacing waste (e.g. removal of the old road surface material); road litter, illegally dumped waste, or general solid waste from the remaining areas. Actually these facts can be seen along all the Baku Shamaki corridor especially in the first section near Dzahngi and surrounding from km 48+000 to km 52+000, near Dzheirankechmaz where some old asphalt equipment have been abandoned together with debris in proximity of the road alignment. Some sheds/warehouses immediately after Maraza, towards Shamaki, have been also completely abandoned. Moreover animal carcasses, vegetation waste from road maintenance; and sediments and sludge from stormwater drainage system maintenance (including sediment traps and oil/water separation systems) can be easily found along the entire corridor.

MATERIALS EXTRACTION IMPACTS

Dust Emissions

Particulate Matter (PM) is generated during all phases of exploitation and processing from fugitive sources (e.g. shovelling, ripping, drilling, blasting, transport, crushing, grinding, screening, and stockpiling). The main sources of PM emissions include crushing–grinding, drilling, blasting, and transport. Impacts of PM emissions are related to its size (e.g. whether it is less than 2.5 microns in diameter), its main components (e.g. silica, silicates, carbonates), as well as to rock impurities and trace components (e.g. asbestos). For dust emissions, the recommended pollution prevention and control techniques should take the ecological and human toxicity of the dust into account.

Hydrology

Surface water regimes may be altered because of flow diversions, water intake, and changes to the drainage pattern.

Solid Waste

Rock waste and removed topsoil–overburden are the main inert wastes produced by quarrying activities. Hazardous wastes may be generated from impurities and trace components included in the exploited (waste) rocks (e.g. asbestos or heavy metals or minerals that could result in acidic runoff). Other waste generated during extraction site operations are oily debris and contaminated soils recovered from lubricants or fuel spills, metal scraps, demolition materials.

Land Conversion

Excavation activities at construction materials extraction sites often involve major topographical and land-cover changes to allow extraction activities, often including clearing of pre-existing vegetation. Opportunities to create ecologically valuable habitats should be considered (e.g. small lakes and pools with a complex shoreline and shallow water zones, after dredging or areas for natural succession) especially nearby Sabir. Here old abandoned borrow pits and the excavation of new areas can be restored in such a way to create integrated areas for public purposes (parks, urban gardens, water games, pools, open theatres etc).

Water

Construction materials extraction projects can significantly alter surface and groundwater regimes that can be potentially used in Sabir – Shamaki areas and surrounding by local communities for potable water supply, fish farming and other edible materials, irrigation, stock watering, and source water for small businesses and industries. The health and well-being of communities can be affected by changes in water quality as a result of discharges from dewatering activities, stormwater discharges, reduced water availability from water diversion, and lowering of groundwater supplies due to dewatering. These effects are often difficult to be predicted and can change while extraction facilities expand their operations. Construction material extraction operators should understand the nature and the extent of community use of water resources, and potential impacts to its quality and availability as a result of dewatering or other hydraulic diversion activities.

Decommissioning

Extraction site reclamation and closure activities should be considered as early in the planning and design stages as possible. Contractors should prepare a reclamation and closure plan that considers factors such as production phasing and overall site life, and project restoration during operations and phasing out as emerged during the public consultation in Sabir. While

plans may be modified, as necessary, during the construction and operational phases, plans should include contingencies for temporary suspension of activities and permanent early closure and meet the following objectives:

Chemical Integrity
Surface water and groundwater should be protected against adverse environmental impacts resulting from excavation and processing activities. Leakages of chemicals into the environment are to be contained so not to endanger public health or safety or exceed water quality objectives in downstream surface water and groundwater systems.

Ecological Habitat Integrity
While ecological habitat integrity is partially determined by the above factors (e.g., physical issues such as slope stability) and chemical issues (e.g. such as metal contaminants), it is also addressed with consideration towards replacement of habitat that is beneficial for future ecological use.

Emission and Effluent Guidelines
Construction materials extraction operations do not typically affect the sources of effluents or emissions, with the possible exception of dewatering effluents which may contain suspended solids. The implementation of total suspended solids (TSS) prevention and control strategies should target concentrations of 50 milligrams per liter (mg/l) at the point of discharge. Stormwater flows should be managed through the application of stormwater management guidance provided in the General EHS Guidelines. The objective of dewatering discharges or stormwater runoff controls should be the prevention of impacts to ambient water quality as described in the General EHS Guidelines. The principal source of air emissions is fugitive dust from earthworks and materials handling and transport activities.

Environmental Monitoring
Environmental monitoring programs for this sector should be implemented to address all activities that have been identified to have potentially significant impacts on the environment during normal operations and upset conditions. Environmental monitoring activities should be oriented to the application of management practices to prevent the sources of impacts. Monitoring frequency should be sufficient to provide significative data for the parameter being monitored. Monitoring should be conducted by trained individuals following monitoring and record-keeping procedures and using properly calibrated and maintained equipment. Monitoring data should be analyzed and reviewed at regular intervals and compared with the operating standards so that any necessary corrective actions can be taken.

5.1.2 Geological aspects

Construction of the Baku - Shamakhi Road would involve a range of activities most of which would occur adjacent to the current roadway. There are some points related to the period of construction which are connected with problems related to the risk of adverse environmental impacts and which may be significant during construction.

As previously advised, due to the corridor topography, several structures such as retaining walls will have to be built to protect the slopes from landslides. The Location and the type of these structures will depend on the properties of the soil and/or bedrock encountered from time to time. In areas characterized by shallow bedrocks, these structures will have to be laid directly on bedrock layers. On the contrary, in other areas the soil may have sufficient bearing capacity for supporting these structures. Where the bedrock is particularly deep and the

overlying soil too soft and with insufficient bearing capacity, a specific design is required for the foundation of such structures. According to the actual conditions of each section the designer identified the type and the final locations of these structures.

Road widening would consist of earthwork cuts and fills and removing existing pavement, laying and grading aggregate base courses to provide a foundation for the roadway surface, and overlaying this foundation with new pavement while at the same time the rehabilitation of the proposed road will be in multiple locations producing dust under significant wind and dry conditions during construction of the road.

The best practices to limit dust pollution will be periodic watering of unpaved areas; using water sprays during the loading and unloading of materials. On-site mixing is to be done at enclosed space, cement, lime powder and other construction materials shall be stored at storage camp or tightly covered. The building materials to be loaded, unloaded and/or handled shall be covered, closed or sprinkled, and none of them shall be thrown or spread into the air. Site stockpiling of materials will be designed and laid out to minimize exposure to wind, and water mixing or sprays will be used on stockpiles as required if particularly dusty activities are necessary during dry or windy periods. Also, environmental impacts may result from concrete batching plant operations, use of blinding cement on roadways to stabilize the subsurface layers below the asphalt course by cement if needed. All the above measures will help to reduce impacts of dust during construction period to its minimum.

Construction site can cause impacts also to sediment, the most common pollutant washed from sites activities. Sediment is produced when soil particles are eroded from the land and transported to surface waters. Natural erosion usually occurs gradually because the vegetation protects the ground and when land is cleared or disturbed to build a road, the rate of erosion increases, the vegetation is removed and the soil is left exposed, to be quickly washed away by the next rain.

5.1.3 Air and Noise aspects

Air

Pollutant emissions during road construction and laying works relate mainly to: earth movement, transport and handling of other building materials. Dust emissions vary from day to day, depending on activities, specific operations and weather conditions. Mainly, equipment and vehicles traffic within the construction site generates dust emissions.

During the construction period, the works involve the following:

- works within the site: earthworks, construction of roadway, major structures, storm water drains and related works
- vehicular traffic.

The construction works involve operations that represent sources of dust emission into the air. These operations include: earthworks, material to spoil and earthworks surface disturbance.

Wind erosion represents an additional dust source. It occurs due to the presence of uncovered areas, which are exposed to wind action for a certain period of time. The dust produced by material handling and wind erosion usually has natural origins (soil particles, mineral dust).

There are also pollution emission sources specific for internal combustion engines, if the engines of the equipment used in different works on site. Another pollutant source specific for

internal combustion engines is the vehicle traffic (vehicle carrying materials and products used in the construction works).

The works within the site, especially the ones carried out for earthwork reinforcement, represent the pollution sources with the highest atmospheric pollution potential.

The pollutant quantities discharged into the atmosphere by vehicles and equipment depend mainly on the following:

- engine manufacture procedure
- engine power
- fuel consumption per unit of power
- equipment capacity
- engine/equipment age.

Obviously, the higher engine performance, the lower pollutant emissions.

The environmental media that can be affected by atmospheric pollutant emissions are:

Population: population could be affected by high concentrations of total suspended particles (TSP) in the vicinity of the constructed roads or by the synergic effect of the PM10 and NO_2. It shows up only for short periods of time, exceeding the health protection limit for synergic effects of these two pollutants.

Vegetation: During construction period short-term situations of chemical stress on vegetation may appear due to exposal to pollution with NO.

Soil and underground: During the construction phase equipment and vehicles shall produce along the main road and on access roads particles charged with heavy metals that shall deposit themselves on the surrounding soil. Therefore there is a possibility for the soil in the above-mentioned areas to be contaminated by Cd, Cu, Cr, Ni, Se, Zn, locally.

Constructions: Acid gases (NO_2, SO_2) and the particles discharged in the atmosphere during the works shall temporarily contribute to increasing the aggressiveness.

Noise

The construction site will generate problems linked to the noise emissions and vibrations connected to both the working activities and the materials movement.

The acoustic characteristics are strongly related to the nature and the location of the machine tools and the distance noise (>200 m from the sources); nuisance largely depends on additional external factors such as:

- weather phenomena and in particular: speed and direction of the wind, as well as its gradient of temperature
- higher or lower degree of absorption of the acoustic waves into the soils, phenomenon called "soil effect"
- air absorption (which depends on the pressure, temperature, relative humidity);
- field operation
- vegetation type.

The study on the noise pollution starts from general consideration on construction activities normally put in place for similar projects. These general considerations have been the base for the development of the specific measures for the project described in this report and the EMP. The construction of the motorway implies the use of machinery with big mass, which cause

vibrations with their movements. A particular case is represented by dumpers, which have big mass also when empty. Construction machinery and transport vehicles are the main source of noise and vibrations during the construction period. They are usually located at in central area of the construction site. During the construction period solutions must be proposed to enable monitoring of noise levels according to the local regulations and to the actual development of the activities.

Regarding vibrations, even though there are reasons for their occurrence within the earthwork structure, especially in the case of the heavy equipments, the analyzed road is generally not based on rock foundation and there are intermediate layers that have the role of breaking vibrations. Therefore potential risks are not envisaged for this aspect.

5.1.4 Socio-economic impacts

The analysis of impacts on the socio-cultural environment included the on-site analysis and the consultation of literature, statistical data and other reports and documentation as well experience occurred in similar circumstances. The potential impacts of the road works on the socio-economic environment during construction period have been identified and analyzed regarding:

- timing
- type of impact
- nature
- temporal magnitude/duration
- reversibility

Indicators, which have been evaluated for the selected alignments, were:

- population and settlements: Population directly and indirectly affected, resettlement/ displacement of people;
- social structure and cultural values: Social disturbance, degradation of cultural and aesthetic resources, impacts on cultural heritage sites;
- property values: removal of houses and other buildings, loss of agricultural land;
- access to social services: Improved access to education facilities, health facilities;
- better accessibility to the urban centres and better connection between the existing community, municipalities and villages;
- road safety: reduction of accidents due to upgrading of road and improved design together with potential increase of accidents due to augmentation of motorisation and travel speed;
- decentralization of some economic activities especially in the Small/Medium Enterprises (SME) sector as well in the tertiary activities able to increase the working opportunity in Dzhangi, Gobustan, Sabir and Shamakhi as well as in the villages and settlement directly connected to the Baku- Shamakhi road upgrading.

Social structure and cultural values

Social disturbance

Indirect disturbances can be related to traffic congestion during the construction period in locations of interchanges/overpasses. Traffic calming or other measures should be implemented during construction. Planned detours must be designed in advance in such a way to safeguard economic activities existing along the road.

Construction Camps

The road works will require working camps and most of the crew are likely to live in temporary facilities.

Although local workers shall be engagedwhere and when available, the contractors are likely to employ semi-skilled and skilled workers from outside the area and a number of 100-150 workers on site are not uncommon. The presence of these workers, mainly men, in the camps can have some impacts on the local community. In general the camps are well accepted since they create employment and commercial opportunities also for local people. Nevertheless, the cash availability among migrant workers might cause personal conflicts. If careful planned, liaison and other actions are undertaken, social problems concerning conflicts between workers and local communities will be minimal. However during construction, detour roads, location of storage sites and construction camps have to be planned carefully in order not to disturb the local communities.

5.2 Effects during Operation and Maintenance Period

5.2.1 Biological aspects

Road Maintenance

Regular maintenance of vegetation along the road is necessary to avoid interference with vehicular traffic and road maintenance. Uncontrolled growth of trees and plants can cover signals and signs, restrict motorist visibility, fall onto the road and damage power lines. Regular maintenance of the road to control vegetation may involve the use of mechanical methods (e.g. mowing), manual methods (e.g. hand pruning), and the use of herbicides. Vegetation maintenance which goes beyond what is strictly necessary for road safety may result in the continuous replacement of succession species and in an increased likelihood of establishment of invasive species. An integrated approach to vegetation management demonstrates that the use of herbicides is the preferred method to control fast growing vegetation within road boundaries. While using herbicides the associated risks have to be taken into account, including the World Health Organization (WHO) Classification of Pesticides by Hazard Classes 1a and 1b, the WHO Classification of Pesticides by Hazard Class II (if the project host country lacks restrictions on distribution and use of these chemicals, or if they are likely to be accessible to personnel without proper training, equipment, and facilities to handle, store, apply, and dispose of these products properly), and Annexes A and B of the Stockholm Convention, except the conditions noted in the convention.

Stormwater

Roads increase the amount of impermeable surface area, which increases the rate of surface water runoff. High stormwater flow rates can lead to stream erosion and flooding. Stormwater may be contaminated with oil and grease, metals (e.g. lead, zinc, copper, cadmium, chromium, and nickel), particulate matter and other pollutants released by vehicles on the road, in addition de-icing salts (e.g. sodium chloride and magnesium chloride) and their substitutes (e.g. calcium magnesium acetate and potassium acetate) from road maintenance facilities in cold climates can be also present. Stormwater may also contain nutrients and herbicides used for control of vegetation in along the road boundaries. For this potential impacts and related specific effects on the project, reference is made to the EMP and to the provisions of the national environmental laws.

Road De-icing
Cold climates may require the clearing of snow and ice from road surfaces during the winter season.

Waste
Solid waste may be generated during maintenance of roads and associated structures. Solid waste generation during operation and maintenance activities may include road resurfacing waste (e.g. removal of the old road surface material); road litter, illegally dumped waste, or general solid waste from rest areas; animal carcasses; vegetation waste from road maintenance; and sediment and sludge from storm water drainage system maintenance (including sediment traps and oil / water separation systems). Paint waste may also be generated from road and bridge maintenance (e.g. due to removal of old paint from road stripping and bridges prior to re-painting).

5.2.2 Geological aspects

The project will significantly change the landscape, as almost for the whole length of the first section the road will not be at same level as the natural ground level. In particular the high embankments section (more of 3 m) and the road overpasses and bridges will significantly alter the topography. The kind and the level of impact however are different on the different sections of the project in correspondence of the different landscaping. Relevant impacts are related to the construction period, due to water contamination and pollution, and to the operation and maintenance of the road.

A management plan should be prepared by the contractor to reduce potential environmental and human health impacts complying with State Laws. As a practical matter, management measures can often be achieved by applying best management practices appropriate to the source of runoff, runoff location, and climate. Geographic information can also be useful especially with regards to the spatial extent of groundwater resources.

The key management practices for road construction, maintenance and operation are:
- protect areas that provide important water quality benefits or are particularly susceptible to erosion or sediment loss
- limit land disturbance such as clearing and grading and cut fill to reduce erosion and sediment loss
- limit disturbance of natural drainage features and vegetation
- place bridge structures so that sensitive and valuable aquatic ecosystems are protected
- prepare and implement an approved erosion control plan
- ensure proper storage and disposal of toxic material
- incorporate pollution prevention into operation and maintenance procedures to reduce pollutant loadings to surface runoff
- develop and implement runoff pollution controls for existing road systems to reduce pollutant concentrations and volumes
- runoff control measures can be installed at the time of road and bridge construction to reduce runoff pollution both during and after construction. Such measures can effectively limit the entry of pollutants into surface waters and ground waters and protect their quality, natural habitat for fishes and public health. Pesticides and fertilizers used along road edges and in adjoining lands can pollute surface waters and ground water when they filter into the soil or are blown away by the wind from the area where they are applied

- avoid if possible the road locations that requires numerous river crossings.

5.2.3 Socio-economic environment

The following impacts during operation period have been identified:

Population and settlements:
- population directly affected
- resettlement / Displacement of people

Social structure and cultural values:
- no degradation of cultural and aesthetic resources will be affected during the operation and maintenance period. On the contrary some Holy Place like Diri Baba mausoleum in Gobustan, not very famous (some time not even shown on touristic maps and guides) will be better accessible to locals and foreigners, increasing pilgrimage and the consequent need of reception facilities. It is well known that the religious tourism is one of the most convenient economic and tourist activity being the "tourist" normally very deferential to the religious sites, places and people hosting those attractiveness;
- elements of the motorway causing a long-term negative impact on the aesthetic of landscape are not really envisaged. No long bridges and viaduct and higher embankment are foreseen. Pedestrian bridges and overpasses in the urban areas have been avoided in favour of more active and passive equipment, tools and police control;
- no impact on cultural and aesthetic and natural resources is envisaged for the area. On the contrary a better accessibility to some traditional villages, local gastronomy and restaurants as well as to some mud volcanoes typical of the Azeri landscape can stimulate some tourist investment such as an observatory platform, protecting and increasing the value of these natural monument. Currently the increasing number of visitors to the mud volcanoes, due to the absence of specific view platforms or "belvedere" as well as of structured tourist organization, uses to drive up and around the volcanoes 4-wheel vehicles, damaging the terrain around and making filthy all the surrounding area. On the contrary the presence of physical tourist infrastructure and economic activities well managed and supervised by Scientific Institution and NGO's or other similar organizations, would be a huge support for the local development and for the preservation of the natural attractions.

Access to social services
- improved access to education facilities, health facilities, transport, urban centres
- road improvements can greatly affect accessibility to facilities and services. In fact roads provide a crucial link between physical resources and users in rural and peri-urban centres. The enlarged road is important for providing possibilities of improved transport at local and regional level. The motorway will improve the access to education and other social health facilities located along/next to the road.

Road safety
- less accidents due to upgrading of the road and improved design
- more accidents due to increasing motorisation and travel speed.

Unfortunately the proposed alignment due to budget constrains can provoke a significant increase of the accidents in densely settled areas, but better and modern design, pavement and signing and active and passive measures can hugely reduce such potential risks in comparison to the condition of the present roads. On the other hand the enlargement will

contribute to an increase of accidents due to higher travel speed. This can be reduced by police control and enforcement of appropriate speed limits and trying to change the conduct and driving habits.

In road operations, accidents are caused by various reasons: excessive speed, careless / negligence, improper overtaking, mechanical defects, road obstructions, driver inexperience, passenger disruptions and other. Therefore it is estimated that traffic accidents on the new road are likely to be in the future more a function of traffic volume, rather than a condition of improved standard.

The contractor will present a Traffic and Safety Plan during operation, as the new road can boost traffic safety, but emergency response and service capabilities need to be developed. Safety occurrences during the operation are expected to be significant at intersections but can be highly limited by appropriate signing, interchanges, speed reduction devices, humps, etc.; anyhow all intersections are designed to provide substantial safety conditions.

Economic development

The proposed motorway will have a positive effect on the economic development not only in the area directly connected, but also for the entire country. The Shamakhi and Gobustan Rayon after the completion of the works will be considered as one of the most important "development corridor" of the region.

At the national level the Baku-Shamakhi corridor will boost the capacity of transportation especially for goods and freights. The increase of the commercial speed, as well as the efficiency derived from a better and safer transportation will lead also to a decrease of the transport cost, so all the supply chain management will benefit of this. Moreover and especially for the Azeri transport sector the new enlarged and upgraded road will encourage to achieve a better reorganization of the logistic structure (depots, custom, garages and workshop repair etc) and in general of the urban space all along the roads and settlements crossings. The development of these major infrastructures will also ensure benefits to the institutional organization, entities and sectors of the public administration dealing with the urban planning; they should take advantage from this unique opportunity to better define how urban space may be settled, organized and occupied and also what sorts of zoning, land uses and densities can be applied for future development.

Once the creation of job opportunities related to the construction period will phase out, another more structured economic development will take advantage from the new Baku-Shamakhi road. The improved connection between the Municipalities and the urban areas to the rest of the country will encourage decentralization in the investment of some economic activities, such as travel and transport agencies, logistic and deposit areas, hotels and restaurants, workshop repairs, shops and services dedicated to the transport sector and automotive industries.

It is also envisaged that the development of the tourist sector will receive some advantages. This sector will surely be able to qualify and renew its facilities in order to offer better accommodation near the archaeological, Holy places and high value landscape sites especially in the mountain touristic areas. It will encourage a multiple and better use of the global environment completing the vision between nature and culture heritage.

It is worth to remind that a linear projects as the Baku – Shamakhi involves many stakeholders and that the longstanding benefits will involve several areas and potentially many other people that those directly affected.

From informal traders to mobile vendors, from workshop repair to hotel and restaurant industries a lot of new activities will receive benefits from the new road.

5.2.4 Air and Noise pollution

Air

According to the available information on the existing scenario in terms of air pollution, the Consultant decided to use a mathematical model to study this phenomenon. The Consultant made all possible efforts in order to collect data from existing studies or measurements carried out by local firms in the area, but these efforts did not provide enough information for a comprehensive study, therefore the Consultant decided to follow the EMEP/EEA methodology.

The EMEP/EEA (formerly Corinair) is a programme to establish an inventory of emissions of air pollutants in Europe. It was started by the European Environment Agency Task Force and was part of the CORINE (Coordination of information on the environment) work programme set up by the European Council of Ministers in 1985. From this date the emission factors were periodically updated[2].

The Consultant used a self-developed MS Excel spreadsheet in order to estimate the amount of the main polluting elements produced by road traffic. The emissions taken into consideration were:

- carbon monoxide (CO)
- volatile organic compounds (VOC)
- particulates less than 10 micrometers (PM10)
- carbon dioxide (CO2)
- nitrogen monoxide (NO)

The adopted model integrates the estimation of the daily and annual emission of pollutants, whereas estimations are carried out according the Copert methodologies introduced by the above mentioned EMEP/EEA programme, with a graphical representation of the emission along the project alignment.

The operational steps can be summarized as follows:

- definition of the road project network graph composed by a set of homogeneous links
- estimation of the future vehicle traffic flows
- identification of the fleet vehicle categories
- definition of the average speed according the link types – urban, rural, semi-desert
- estimation of the average mileage per vehicle category
- definition of the representative baseline emission factor for the each pollutant, relevant for each vehicle category

[2]See http://www.eea.europa.eu/themes/air/emep-eea-air-pollutant-emission-inventory-guidebook/emep

- graphical representation of the emissions along the project alignment.

Homogeneous links were defined by dividing the route between km 45+000 and km 121+000 into functional segments based on the characteristics of the alignment and crossed areas (urban, rural, semi-desert etc.) in order to produce a homogeneous evaluation of the pollution along the different sections.

The itinerary is therefore divided into eight homogeneous sections between km 45+000 and km 121+000. They are:

- Link 1: from km 45+000 to km 77+000
- Link 2: from km 77+000 to km 82+000
- Link 3: from km 82+000 to km 95+000
- Link 4: from km 95+000 to km 100+000
- Link 5: from km 100+000 to km 103+000
- Link 6: from km 103+000 to km 105+000
- Link 7: from km 105+000 to km 108+000
- Link 8: from km 108+000 to km 121+000

Traffic flows data are available from the previous feasibility studies, Study of Widening Options for a Four Lane Road between Baku and Shamakhi in Azerbaijan, prepared by Kocks Consult, February 2009, and Economic evaluation of widening Baku – Shamakhi road, prepared by Kocks Consult, January 2010. The next Table 4 presents traffic forecasts for years 2010, 2020 and 2030 as shown in the second of the two above mentioned studies.

Table 4 – Traffic forecasts for the Baku – Shamakhi road

Year	Based on 2005 Annual Average Daily Traffic Flows			
	Km 23.5 – km 57.5	Km 57.5 – Km 91.5	Km 91.5 – km 120	Km 120 – Km 130.6
2010	12,613	12,315	16,591	14,957
2020	24,001	23,452	31,759	28,635
2030	35,314	34,519	46,788	42,121

Source: Economic evaluation of widening Baku – Shamakhi road, Kocks Consult, January 2010

The percentage of heavy vehicles (including buses) on the above values of AADT is low and is generally between 6% and 7%.

The vehicle composition that was adopted for the estimation of the emission is presented into the next table.

Table 5 – Traffic composition for years 2012 -2032

Traffic Categories	2012-2022	2022-2032
Uncatalyzed Light Vehicles - Gasoline	35.1%	0.0%
Catalyzed Vehicles - Gasoline	39.0%	74.0%
Diesel Light Vehicles	17.8%	17.8%
Diesel Heavy Vehicles	8.2%	8.2%

Source: Consultant's elaboration on the basis of the information presented into the Economic evaluation of widening Baku – Shamakhi road, Kocks Consult, January 2010

The above values were estimated from the traffic composition presented into Kocks Consult's study of January 2010 by assuming a comparable proportion of non-catalyzed and catalyzed cars at the present year 2012, with the non-catalyzed quota completely replaced by new cars at year 2022.

The results (in grams/hour) are synthesized in the following three tables.

Table 6 – Estimated emissions and fuel consumption at year 2012

Year: 2012	AADT 2012 Veh/Day	Vehicle Speed Km/h	EM (g/km/Day)					
Links			CO	VOC	PM10	CO2	NOX	Fuel Consumption
Link 1: - km 45+000 to km 77+000	12,991	70	40,888	6,407	169	1,891,351	16,311	599,084
Link 2: - km 77+000 to km 82+000	12,991	60	49,123	8,075	181	1,986,317	15,071	629,265
Link 3: - km 82+000 to km 95+000	17,089	70	53,784	8,428	223	2,487,863	21,455	788,029
Link 4: - km 95+000 to km 100+000	17,089	60	64,615	10,621	238	2,612,779	19,824	827,729
Link 5: - km 100+000 to km 103+000	17,089	60	64,615	10,621	238	2,612,779	19,824	827,729
Link 6: - km 103+000 to km 105+000	17,089	60	64,615	10,621	238	2,612,779	19,824	827,729
Link 7: - km 105+000 to km 108+000	17,089	70	53,784	8,428	223	2,487,863	21,455	788,029
Link 8: - km 108+000 to km 121+000	17,089	50	76,442	12,225	274	2,665,201	18,525	844,487

Table 7 – Estimated emissions and fuel consumption at year 2022

Year: 2022	AADT 2012 Veh/Day	Vehicle Speed Km/h	EM (g/km/Day)					
Links			CO	VOC	PM10	CO2	NOX	Fuel Consumption
Link 1: - km 45+000 to km 77+000	24,721	70	77,806	12,192	322	3,584,728	9,878	1,135,465
Link 2: - km 77+000 to km 82+000	24,721	60	93,474	15,365	344	3,750,961	9,269	1,188,316
Link 3: - km 82+000 to km 95+000	32,518	70	102,345	16,037	424	4,715,311	12,994	1,493,578
Link 4: - km 95+000 to km 100+000	32,518	60	122,955	20,211	453	4,933,973	12,192	1,563,097
Link 5: - km 100+000 to km 103+000	32,518	60	122,955	20,211	453	4,933,973	12,192	1,563,097
Link 6: - km 103+000 to km 105+000	32,518	60	122,955	20,211	453	4,933,973	12,192	1,563,097
Link 7: - km 105+000 to km 108+000	32,518	70	102,345	16,037	424	4,715,311	12,994	1,493,578
Link 8: - km 108+000 to km 121+000	32,518	50	145,459	23,262	521	5,481,834	12,104	1,736,780

Table 8 – Estimated emissions and fuel consumption at year 2032

Year: 2032	AADT 2012 Veh/Day	Vehicle Speed Km/h	EM (g/km/Day)					
Links			CO	VOC	PM10	CO2	NOX	Fuel Consumption
Link 1: - km 45+000 to km 77+000	36,373	70	114,480	17,938	474	5,274,408	14,535	1,670,672
Link 2: - km 77+000 to km 82+000	36,373	60	137,534	22,607	507	5,518,997	13,637	1,748,434
Link 3: - km 82+000 to km 95+000	47,845	70	150,585	23,596	623	6,937,898	19,119	2,197,584
Link 4: - km 95+000 to km 100+000	47,845	60	180,910	29,738	667	7,259,627	17,939	2,299,871
Link 5: - km 100+000 to km 103+000	47,845	60	180,910	29,738	667	7,259,627	17,939	2,299,871
Link 6: - km 103+000 to km 105+000	47,845	60	180,910	29,738	667	7,259,627	17,939	2,299,871
Link 7: - km 105+000 to km 108+000	47,845	70	150,585	23,596	623	6,937,898	19,119	2,197,584
Link 8: - km 108+000 to km 121+000	47,845	50	214,023	34,227	766	8,065,726	17,809	2,555,421

Obviously, emissions increase during the years in parallel with traffic increase, with some exceptions due to the hypothesis of an introduction of a full catalyzed vehicle fleet at year 2022.

A graphical representation of the above value is given in the next pictures.

Figure 24- Estimated CO emissions at years 2012 - 2032

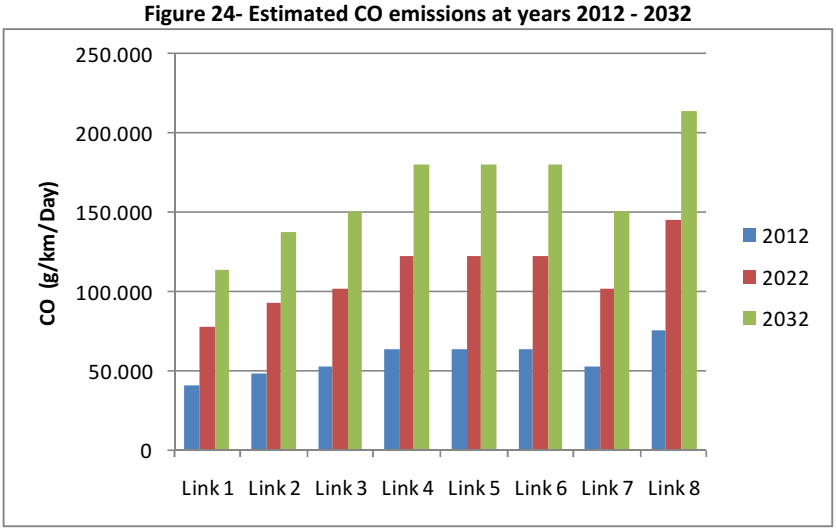


Figure 25- Estimated VOC emissions at years 2012 – 2032

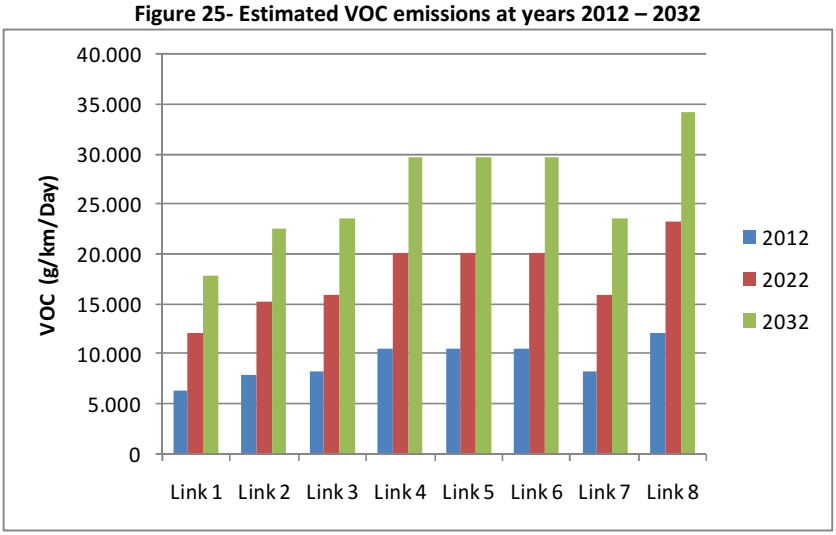


Figure 26- Estimated PM10 emissions at years 2012 – 2032

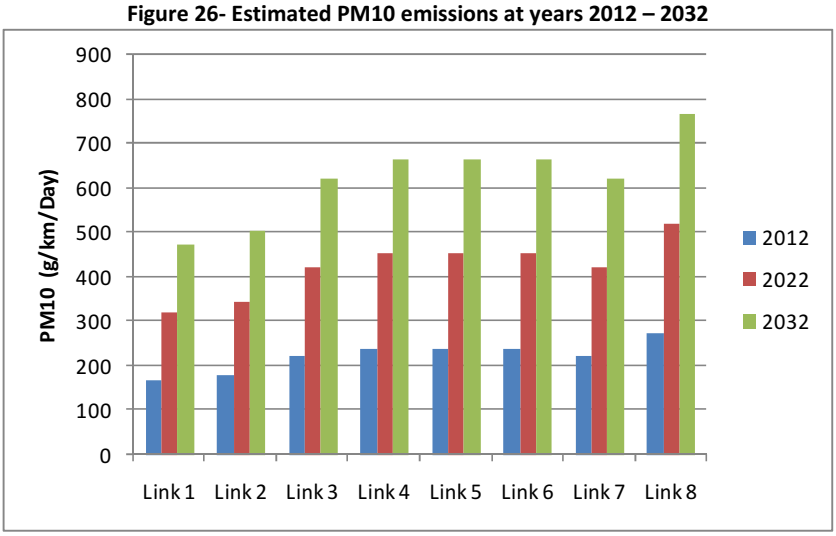


Figure 27- Estimated CO2 emissions at years 2012 – 2032

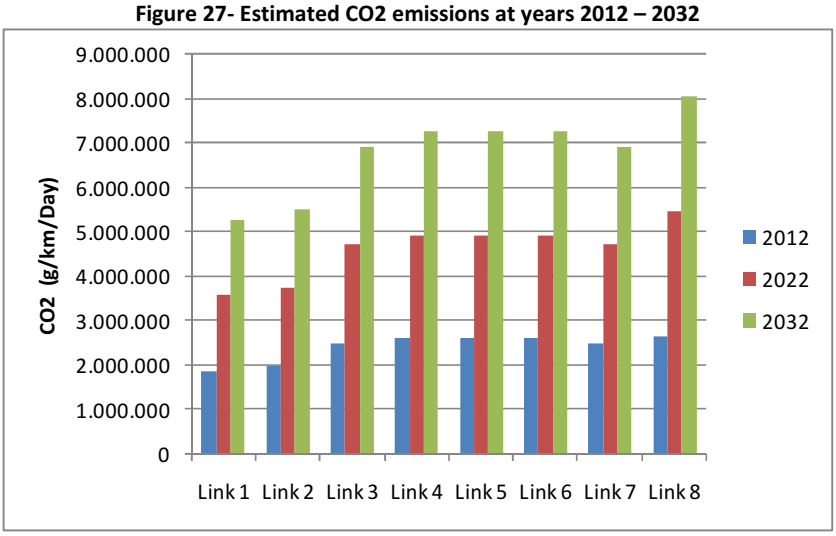


Figure 28- Estimated NOX emissions at years 2012 – 2032

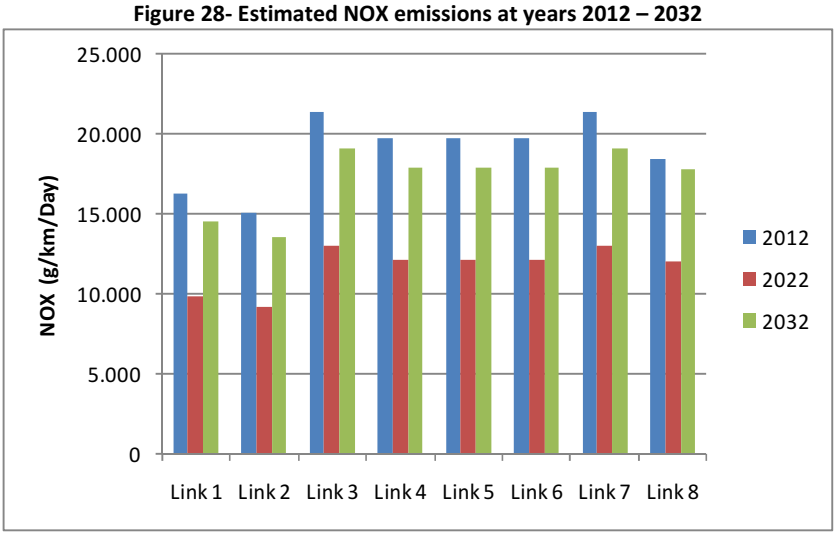
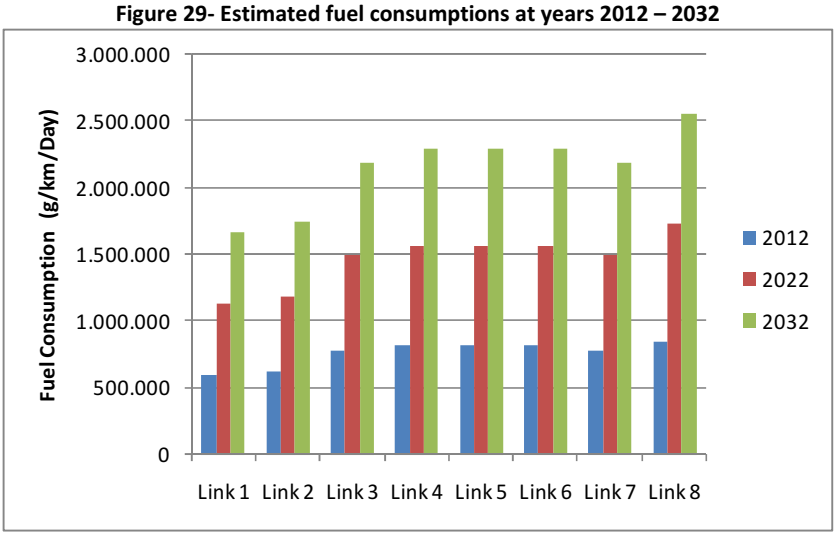


Figure 29- Estimated fuel consumptions at years 2012 – 2032



Noise

The main sources generating noise due to road operations are represented by road traffic. This kind of noise is dominated by the low frequencies spectra and vibrations, which are not sensed unless they reach no eligible values (and this is the reason why the sound pressure level is weighted by the so-called A-scale). It has to be specified that for different heights the noise will vary due to the soil effect and to the particular direction of the sources.

The M4 is a national road that is anticipated to have a number of both benefits (in reducing congestion, adjusting the traffic distribution on the principal road network etc.) and negative impacts as the changes in noise levels in the vicinity of the road itself that will clearly have considerable nuisance value to the affected populations.

Within the extent of this study it will be possible only to foresee the values of some acoustic indicators calculated on the basis of the estimated traffic flows and composition (light and heavy vehicles). The acoustic indicator that will be estimated is represented by the noise level expressed in Leq(A).

At this level of analysis, it is possible to foresee that the new road will have noise impact:
- on sites along its alignment, in both rural and urban cases
- on some sensitive sites (schools, hospitals, mosques, etc.).

According to the standards commonly adopted in Azerbaijan, the maximum allowable noise levels are those presented into the next table.

Table 9 – Maximum allowable noise levels (GOST standards)

Land use	Noise standard (max) in decibel (dBA)	
	Daytime (07:00-23:00)	Night time (23:00 - 7:00)
Residential Areas	40	30
Commercial Areas	55-60	55-60
Hotels and dormitories	45	35
Industrial areas:		
a) highly qualified workplaces	50	50
b) permanent workplaces within territory or buildings of plants	80	80
c) workplaces of track drivers and service	70	70
d) workplaces of drivers and service for tractors and other equivalent agricultural and melioration mechanisms	80	80
Sensitive areas:		
a) hospitals and sanatoriums	35	25
b) schools, libraries and conference halls	40	40

Source: Noise Standards GOST 12.1.003-83 UDK 534.835.46:658.382.3:006.354; GOST 12.1.036-81 ST SEV 2834-80

The standards adopted in Azerbaijan are derived from standards adopted by the former Soviet Union and are very strict. They are referred to indoor noise. As a comparison, acceptable outdoor noise level according to the Italian regulation can be found in the following table.

Table 10 –Maximum allowable Noise levels (sample from the Italian regulations)

Type of area	The maximum limit for LeqA (dB) - equivalent sound level (decibel A)	
	Day	Night
Residential areas in cities	60	50
Residential areas in suburbs	55	45
Residential areas in villages	50	40
Residential areas in that have some workshops or simple vocations or business and commercial and administrative areas and downtown	65	55
Industrial areas (heavy industrial)	75	65
Tuition, worshipping, treatment places and hospitals	45	35

As anticipated into paragraph 4.5, a "corridor" of 250 m of width on both sides of the centerline of the existing alignment was defined in order to collect information about land use and sensitive areas. In particular, worship places (mosques and cemeteries) will be assimilated to category "b" of sensitive areas (schools, libraries and conference halls).

The estimation of the forecast noise level was carried out by using a simulation model that calculated the noise level at specific distances from the carriageway edges for each segment of the considered road. In this analysis the basic noise level was calculated at the reference distance *d* from the carriageway edge for each segment. The variables used in the formulas were the traffic flows (in vehicles / hour), the average speed (in km/h) and the percentage of the heavy vehicles.

The analysis will be elaborated on the basis of average daily traffic and calculated with the following adopted formula (source ENEA[3]):

$$\text{Leq (dB(A)) (Total)} = \text{Leq } (Q, V, d) - A(\text{divergence}) - A \text{ (earth)}$$

where:

$$\text{Leq } (Q,V,d) \text{ (dB(A))} = 9.1 \log (Q_{eq}) - 6.5 \log (d) + 51.2$$

with:

$$Q_{eq} = \alpha(V)\, Q_l + \beta(V)\, Q_p + \gamma\,(V)\, Q_c$$

Whereas:

- Q_p light vehicles flow
- Q_l heavy vehicles flow
- Q_c motorcycles flow (practically not existent in our specific case)
- $\alpha\ \beta\ \gamma$ factors of proportionality in function of average speed flow V
- d reference distance

The model above must be considered within its limits, because it does not take into account local parameters that cannot be estimated (mainly speed and direction of local winds). Nevertheless it permits a "pilot" calculation of the noise levels on sensitive targets along the route considered in this study, thus allowing for a rough but acceptable estimation of impacts.

[3]) ENEA is the name for the Italian National Agency for New Technologies, Energy and Sustainable Economic Development.

As a general information, prevailing winds in the study area are from West to East both during winter and summer seasons.

The following tables show the expected level of noise at the edge of the carriageway estimated for the year 2012 (present situation), 2022 and 2032.

Table 11–Noise pollution from vehicles traffic flows –day and night values at carriageway edge (year 2012)

Links	Annual Average Daily TrafficAADT - 2012	Peak Hour Flows (Veh/h)	Average Flow 6.00-22.00(Veh/h)	Average Flow 22.00 - 6.00(Veh/h)	Vehicles Speed Km/h	Light vehicles92%	Heavy vehicles 8%	Leq A(Peak Hour)	Leq A – Day 7.00 -23.00	Leq A – Night 23.00 - 7.00
Link 1: from km 45+000 to km 77+000	12,991	909	690	244	70	837	73	71.2	70.1	66.0
Link 2: from km 77+000 to km 82+000	12,991	909	690	244	60	837	73	69.8	68.7	64.6
Link 3: from km 82+000 to km 95+000	17,089	1,196	908	320	70	1,101	96	72.3	71.2	67.1
Link 4: from km 95+000 to km 100+000	17,089	1,196	908	320	60	1,101	96	70.9	69.8	65.7
Link 5: from km 100+000 to km 103+000	17,089	1,196	908	320	60	1,101	96	70.9	69.8	65.7
Link 6: from km 103+000 to km 105+000	17,089	1,196	908	320	60	1,101	96	70.9	69.8	65.7
Link 7: from km 105+000 to km 108+000	17,089	1,196	908	320	70	1,101	96	72.3	71.2	67.1
Link 8: from km 108+000 to km 121+000	17,089	1,196	908	320	50	1,101	96	69.9	68.9	64.7

Table 12 – Noise pollution from vehicles traffic flows - day and night values at carriageway edge (year 2022)

Links	Annual Average Daily TrafficAADT - 2012	Peak Hour Flows (Veh/h)	Average Flow 6.00-22.00(Veh/h)	Average Flow 22.00 - 6.00(Veh/h)	Vehicles Speed Km/h	Light vehicles92%	Heavy vehicles 8%	Leq A (Peak Hour)	Leq A – Day 7.00 -23.00	Leq A – Night 23.00 - 7.00
Link 1: from km 45+000 to km 77+000	24,721	1,730	1,313	464	70	1,592	138	73.7	72.6	68.5
Link 2: from km 77+000 to km 82+000	24,721	1,730	1,313	464	60	1,592	138	72.4	71.3	67.2
Link 3: from km 82+000 to km 95+000	32,518	2,276	1,728	610	70	2,094	182	74.8	73.7	69.6
Link 4: from km 95+000 to km 100+000	32,518	2,276	1,728	610	60	2,094	182	73.5	72.4	68.3
Link 5: from km 100+000 to km 103+000	32,518	2,276	1,728	610	60	2,094	182	73.5	72.4	68.3
Link 6: from km 103+000 to km 105+000	32,518	2,276	1,728	610	60	2,094	182	73.5	72.4	68.3
Link 7: from km 105+000 to km 108+000	32,518	2,276	1,728	610	70	2,094	182	74.8	73.7	69.6
Link 8: from km 108+000 to km 121+000	32,518	2,276	1,728	610	50	2,094	182	72.5	71.4	67.3

Table 13 – Noise pollution from vehicles traffic flows - day and night values at carriageway edge (year 2032)

Links	Annual Average Daily TrafficAADT - 2012	Peak Hour Flows (Veh/h)	Average Flow 6.00-22.00(Veh/h)	Average Flow 22.00 - 6.00(Veh/h)	Vehicles Speed Km/h	Light vehicles92%	Heavy vehicles 8%	Leq A (Peak Hour)	Leq A - Day 7.00 -23.00	Leq A - Night 23.00 - 7.00
Link 1: from km 45+000 to km 77+000	36,373	2,546	1,932	682	70	2,342	204	75.3	74.2	70.1
Link 2: from km 77+000 to km 82+000	36,373	2,546	1,932	682	60	2,342	204	73.9	72.8	68.7
Link 3: from km 82+000 to km 95+000	47,845	3,349	2,542	897	70	3,081	268	76.3	75.3	71.1
Link 4: from km 95+000 to km 100+000	47,845	3,349	2,542	897	60	3,081	268	75.0	73.9	69.8
Link 5: from km 100+000 to km 103+000	47,845	3,349	2,542	897	60	3,081	268	75.0	73.9	69.8

Link 6: from km 103+000 to km 105+000	47,845	3,349	2,542	897	60	3,081	268	75.0	73.9	69.8
Link 7: from km 105+000 to km 108+000	47,845	3,349	2,542	897	70	3,081	268	76.3	75.3	71.1
Link 8: from km 108+000 to km 121+000	47,845	3,349	2,542	897	50	3,081	268	74.0	72.9	68.8

Impact on sensitive sites was estimated as presented in the following tables.

Table 14 – Noise pollution from vehicles traffic flows – daytime impact on sensitive sites

			year	2012	2032
Sensitive Sites	**Locations Chainage / Km**		**Distance by edge of carriageway (m)**	**Leq A (dB) (7.00 - 23.00)**	**Leq A (dB) (7.00 - 23.00)**
School	Dzhangi	46+750	245	57	61.1
Mosque	Dzhangi	48+100	30	66.1	70.2
School	Narimankand	78+900	250	55.6	59.6
Mosque	Narimankand	79+320	25	65.6	69.6
Cemetery	Narimankand	80+150	180	57.0	61.0
School	Narimankand	80+320	150	57.8	61.8
Mosque	Sabir	103+000	220	57.2	61.3
School	Sabir	103+360	50	63.6	67.7
Cemetery	Sabir	104+000	20	67.6	71.7
Mosque	Sabir	104+450	100	60.6	64.7
Museum	Shamakhi	109+600	60	61.9	65.9
Cemetery	Shamakhi	110+450	80	60.6	64.7
School	Shamakhi	110+700	60	61.9	65.9
Cemetery	Shamakhi	111+500	10	69.7	73.7

Table 15 – Noise pollution from vehicles traffic flows – night impact on sensitive sites

			year	2012	2032
Sensitive Sites	**Locations Chainage / Km**		**Distance by edge of carriageway (m)**	**Leq A (dB) (23.00 - 7.00)**	**Leq A (dB) (23.00 -7.00)**
School	Dzhangi	46+750	245	52.9	57.7
Mosque	Dzhangi	48+100	30	62	66.1
School	Narimankand	78+900	250	51.4	55.5
Mosque	Narimankand	79+320	25	61.4	65.5
Cemetery	Narimankand	80+150	180	52.9	56.9
School	Narimankand	80+320	150	53.7	57.7
Mosque	Sabir	103+000	220	53.1	57.1
School	Sabir	103+360	50	59.5	63.6
Cemetery	Sabir	104+000	20	63.5	67.6
Mosque	Sabir	104+450	100	56.5	60.6
Museum	Shamakhi	109+600	60	57.8	61.8
Cemetery	Shamakhi	110+450	80	56.5	60.6
School	Shamakhi	110+700	60	57.8	61.8
Cemetery	Shamakhi	111+500	10	65.5	69.6

The tables above present in bold the values referred to the two sensitive sites located between km 45+000 and 67+500, i.e. the first section of the road. It is clear that the forecast outdoor noise level exceeds the allowable indoor noise levels admitted by the GOST standards (40 dBA for sensitive sites, for both day and night times - see table at paragraph 2.1) and therefore some mitigation measures will be necessary in order to reduce the indoor noise levels and to assure an acceptable level of noise inside the premises located along the road, as presented into the next paragraph 7.2.4 at page 99.

6 THE SELECTED ALIGNMENT

6.1 Introduction

The selected alignment is a consequence of:

- available budget for the widening of the Baku- Shamakhi Road
- general physical and geological conditions of the existing alignment
- efforts to avoid as much as possible any environmental impact especially in sensitive areas (prone to erosion areas, some limited wetland seasonal areas)
- need to preserve the limited agricultural and arable soil in a context of almost deserted territory
- attention paid to prevent any impact on sacred places such as cemetery, mosque and holy place as well social infrastructure (schools, hospital and medical centres)
- By pass alternatives where independently from the budget, no other solutions can be found out at a reasonable cost. The designer and the environmental consultant's main efforts were focused to avoid as far as possible the crossing of the urban areas of the main settlements located along the Corridor proposing alternative routes especially in the centre of:
    - Dzhangi
    - Narimankand- Maraza (now Gobustan)
    - Sabir

For Sabir the solution proposed by the designer is the construction of a new bridge on the East side of the existing one along the current alignment. This will not bring any costly land acquisition as the road goes through steppe-like areas and abandoned mining fields. The mitigation measure proposed (see chapter 7) can be considered valid alternatives if accompanied with sound and appropriate urban planning design for the concerned areas. It has also to be noted that if the forecast volume of traffic vehicle till 2030 and the road design characteristics are compared, the achievement of any critical volume of traffic (i.e. that volumes that may bring to road congestion phenomena) will take enough time to ask for future improvements - See HCM 2000 –Highway Capacity Manual For Level of Services -LOS from A to E for a traffic capacity <pc/Km/ln.

To avoid as much as possible the consequence of crossings, special measures have been adopted to ensure high standard of road safety as well air and noise pollution reduction (see chapter 4.4.1, 4.4.4, 5.1, 5.2, 7.1.3, 7.2.3).

In the following paragraphs, tentative options are analyzed.

Dzhangi

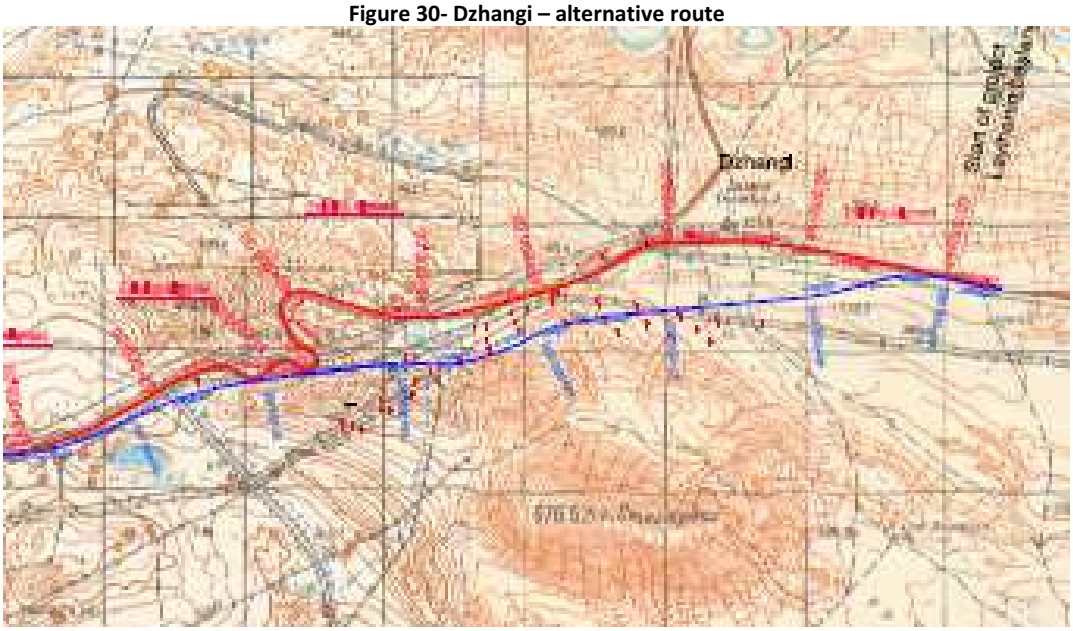
The village of Dzhangi will be partially by-passed by a new 2 lane road approximately 300m to the south of the existing road. This is in order to avoid a prone to erosion area. The new road will be used only for traffic travelling in the direction of Baku whilst the existing road will be devoted for traffic heading to Shamakhi in the opposite direction.

The existing road will have safety barriers installed to limit to road access and to reduce the opportunities for passing traffic to stop at roadside shops. A local access road will be provided, parallel to the existing road, while a junction will be realized at Dzhangi to allow traffic passing to access the village.

Envisaged Possible impacts

- Decreased noise - part of the traffic will be further diverted from properties
- Reduced access – the verge barrier will prevent passing vehicles to stop at roadside businesses
- Reduced access – access to roadside properties will be via local access road
- Reduced access – the barriers will reduce pedestrians (and animals) crossing of the road – alternative means of access will be required
- short term increase in noise and dust during construction,
- possible traffic congestion – particularly from the borrow pits located close to Dzhangi

Figure 30- Dzhangi – alternative route



Narimankand & Maraza

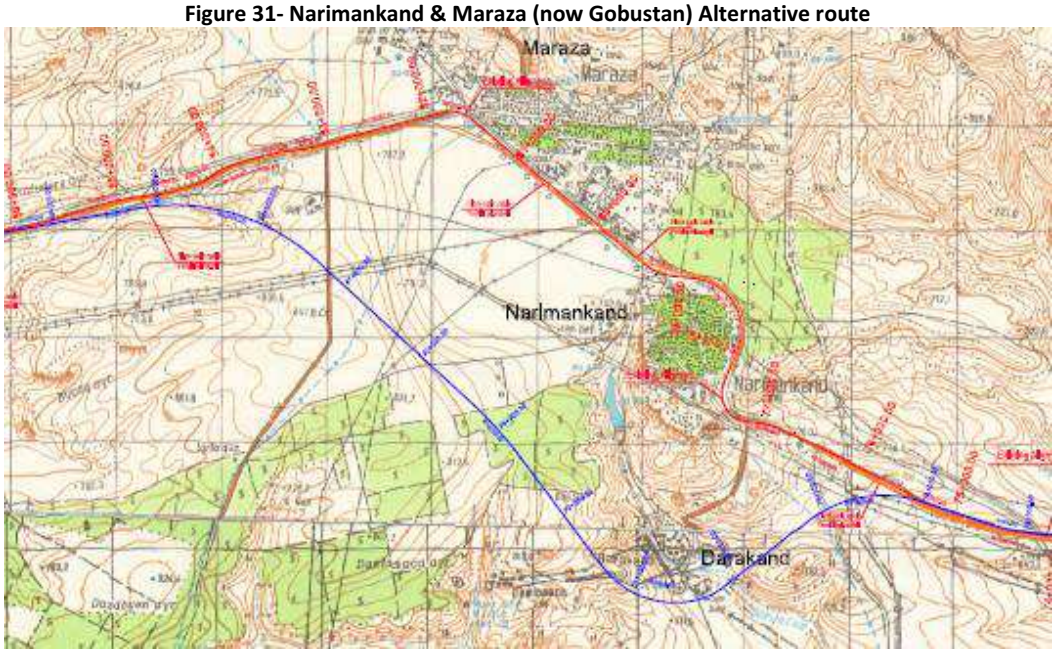
During the detailed design stage it has been decided to avoid the by-pass and to make the upgrade of the existing alignment widening the road on the west side. Obviously, in order to ensure the required level of safety, traffic calming measures such as roundabouts, acceleration and deceleration lanes for connecting roads, etc. have been designed for this section.

Envisaged Possible impacts

- Decreased noise in Maraza and Narimankand
- Possible increased noise in Darakand
- Reduced access – the by-pass will prevent passing vehicles to stop at roadside businesses in Maraza and Narimankand while the barriers will reduce pedestrians (and animals) crossing of the road – alternative means of access will be required

- Access to roadside properties in Maraza and Narimankand will be via the existing road and new junctions
- Sensible footprint on some area ranging from medium to high agricultural value
- Viaduct to be constructed south of Darakand
- Short term increase in noise and dust during construction.

Figure 31- Narimankand & Maraza (now Gobustan) Alternative route



Sabir

The village of Sabir is reasonably heavily populated. Most of the development is concentrated on the left side of the road (i.e. on the South side), while a mixture of residential properties and businesses is gathered on the right hand side, including a cemetery. No access control is foreseen.

The existing road is a single carriageway with shoulders on both sides characterized by significant traffic volumes. In addition to that, several side roads are typical of this section.

Four alternatives were analyzed:

Alternative 1

The existing road through Sabir will be upgraded (on the right side) to a dual carriageway with a median and shoulders. This will involve the construction of a new bridge to the right side of the existing bridge. The new road will pass very close to the cemetery at km 104 but will not require any land acquisition.

Envisaged Possible impacts
- Increased noise - vehicles passage will be closer to properties
- Reduced access – the verge barrier will prevent passing vehicles to stop at roadside businesses
- Reduced access – access to roadside properties will be via a local access road

- Reduced access – the barriers will reduce pedestrians (and animals) crossing of the road – alternative means of access will be required
- Short term increase in noise and dust during construction
- Possible traffic congestion during construction
- Increased numbers of trucks passing through Sabir during construction, due to the expected utilization as construction material sources of local rock quarries along the River Pirsaat, which runs through Sabir.

Alternative 2

The road will bypass Sabir village at the km 102 up to the North, crossing a partially deserted and steppe-like land. Construction of a new bridge, including an interchange, to overpass the Pirsaat River is envisaged. Once the interchange is passed, the road will gradually reach the existing alignment. Land acquisition of low value is necessary.

Envisaged Possible impacts
- A costly new bridge is necessary with an expensive interchange;
- Increased numbers of trucks passing through Sabir during construction, due to the expected utilization as construction material sources of local rock quarries along the River Pirsaat, which runs through Sabir;
- Reduced access – the verge barrier will prevent passing vehicles to stop at roadside shops
- Reduced access – the barriers will reduce pedestrians (and animals) crossing of the road – alternative means of access will be required

Alternative 3

The road will bypass the village of Sabir at km 100 on the South direction. In the first part the road will cross a hilly area, requiring the construction of a new bridge to overpass the Pirsat river. The second part of the road will cross agricultural land, heading to Shamaki South, down to the artificial lake of Zagalavooy. Land acquisition of medium-high value is required.

Envisaged Possible impacts
- Construction of expensive new bridge
- Medium - High value land acquisition required
- High footprint on agricultural land
- Decreased value of the property due to property fragmentation
- Reduced access – the verge barrier will prevent passing vehicles to stop at roadside shops in Sabir
- Reduced access – the barriers will reduce pedestrians (and animals) crossing of the road – alternative means of access will be required
- Overpassing and possible reinforcement of erosive soil

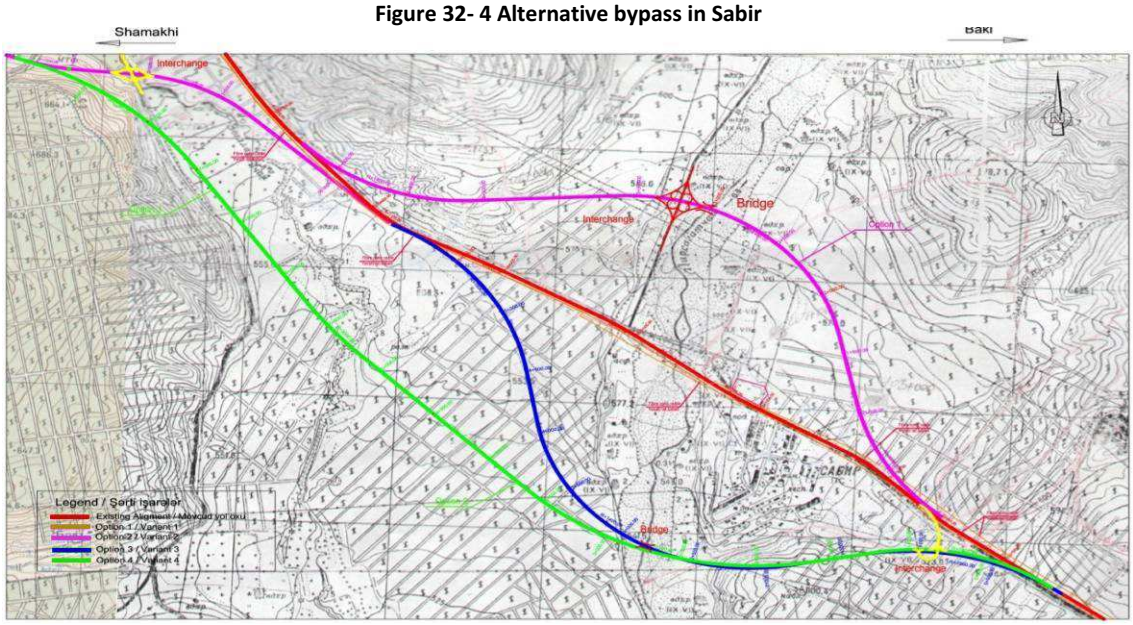
Alternative 4

The route is the same provided according to alternative 3, the difference is the road which joins the existing road at km108 with minor impact on agricultural soil.

Envisaged Possible impacts

The possible impacts are the same provided for the Alternative 3 but with less impact on agricultural land.

Figure 32- 4 Alternative bypass in Sabir



Final Remarks

Finally for the third section in coincidence with the village of Sabir the Alternative 1 was selected.

The following aspects have been taken into account:

- the volume of forecasted traffic up to the year 2030,
- the advisability to provide the population with by passes in the next 15-20 years, should the volume of traffic severely impact the community villages (especially for Gobustan and Sabir)
- the strict adoption of road design adequate criteria and safety measures to be used in the urban areas (see chapter 7.2.3 and 7.3.4);
- the contemporary adoption of detailed Master Plan for the community involved to improve the organization of the urban development and spatial planning along the urban area;
- the adoption of specific engineering methodologies, proper water channelling measures and techniques to stabilize the slopes prone to erosion and prevent landslides;
- the minimization of agricultural land acquisition, especially in the areas nearby Shamakhi, Sabir and Gobustan, considering the high value of agriculture land in Azerbaijan;
- localization of animal crossings and underpasses;
- detailed design of the animal crossing, underpasses and bridge have to comply with the international standards as well the recommendation stated at paragraphs 7.2.3 and 7.2.4 and 7.4

6.2 Definition of the alignment

Proposed upgrading

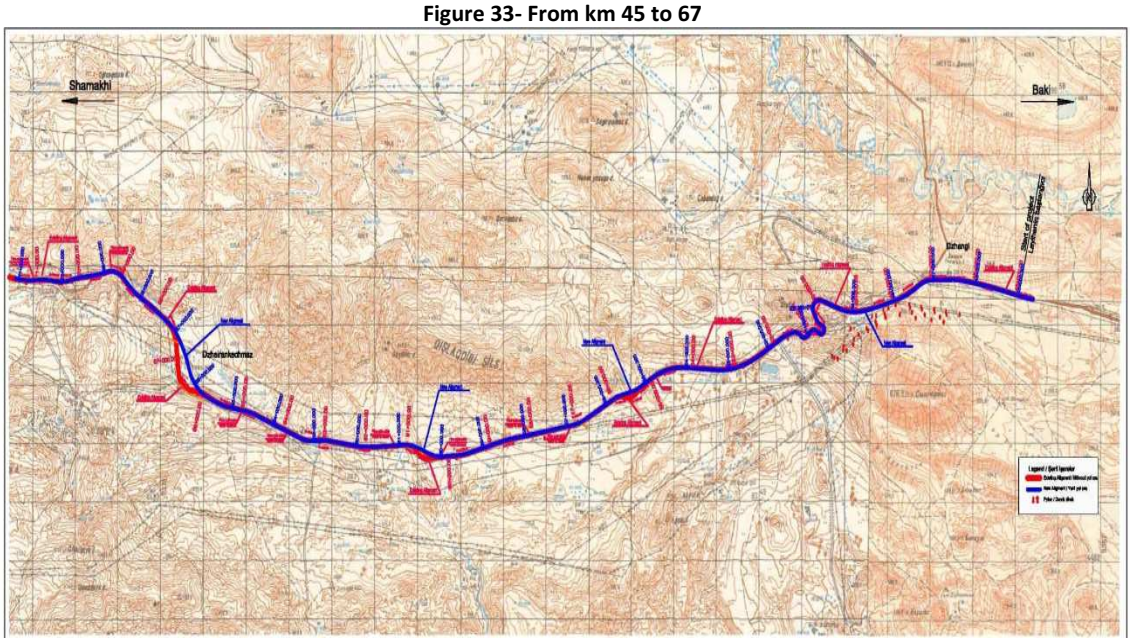
The scheme involves mainly on-line widening; therefore the widened road will pass through a number of settlements as follows:

Dzhangi

The road will be widened to 4 lanes following the existing alignment. This will mean that the new road alignment will run along the same private properties as the existing one. In particular this is what would happen at km 47 in correspondence of the curve to the left. At the Public Consultation meeting held on the 3rd December 2011, a preference was expressed for the on-line widening.

The new road will have safety barriers installed to restrict access to the road and reduce the opportunities for passing traffic to stop at roadside shops. A local access road running parallel to the existing road will be constructed including a junction, it will allow the access to the Dzhangi village.

Figure 33- From km 45 to 67



Dzheirankechmaz

The small village of Dzheirankechmaz will be by-passed by a new 4-lane road approximately 200m to the North of the existing alignment. The new road will reduce the opportunities for passing traffic to stop at roadside shops. A local access road will be constructed parallel to the existing road, including a junction to the village. Wildlife crossing measures may be required.

Narimankand & Maraza

The road will be widened to four lanes following the existing alignment. This will mean that the road will run closer to the existing private properties than it does currently. In particular this is what would happen in the vicinity of Narimankand, where the road will be widened on the right side. In Maraza the existing road will be used for the local access and a new 4-lane road will be constructed to the left of the adjacent existing road. New junctions will be constructed in order to assure access to the Maraza and Narimankand villages.

Figure 34- From km 70 to 90

Sabir

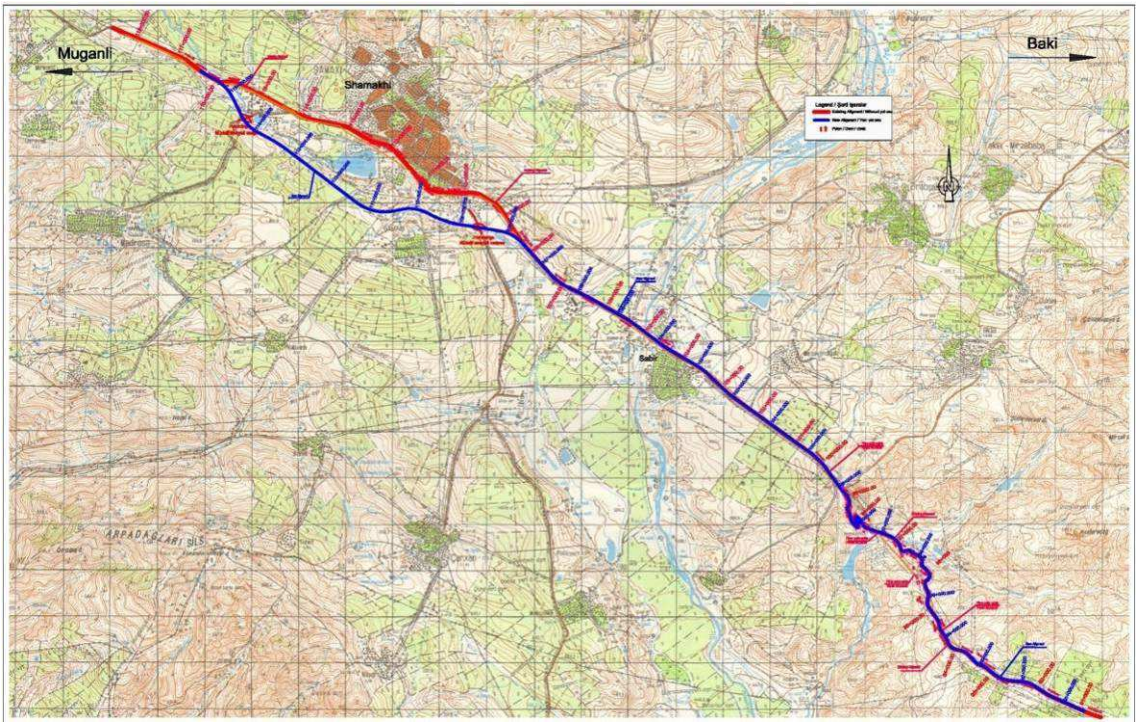
The existing road is a single carriageway with shoulders on both sides. Traffic volumes are quite high and along this section there are several side roads.

The existing road will be widened (on the right hand side) to a dual carriageway including median and shoulders. This will involve the construction of a new bridge to the right side of the existing bridge. The new road will pass very close to the cemetery at km 104, however it will not require any land acquisition.

Shamakhi

Shamakhi will be by-passed by a new 4-lane road passing to the south of the village and crossing farm lands. Therefore the construction of such new road will involve the acquisition of some properties. The by-pass will reduce the traffic volume through Shamakhi and will reduce the opportunities for passing traffic to stop at roadside shops. The existing single carriageway will be used for local access. Finally two junctions will be constructed to provide access to Shamakhi.

Figure 35- From km 90 to 121



KM 121 – CURRENT SITUATION

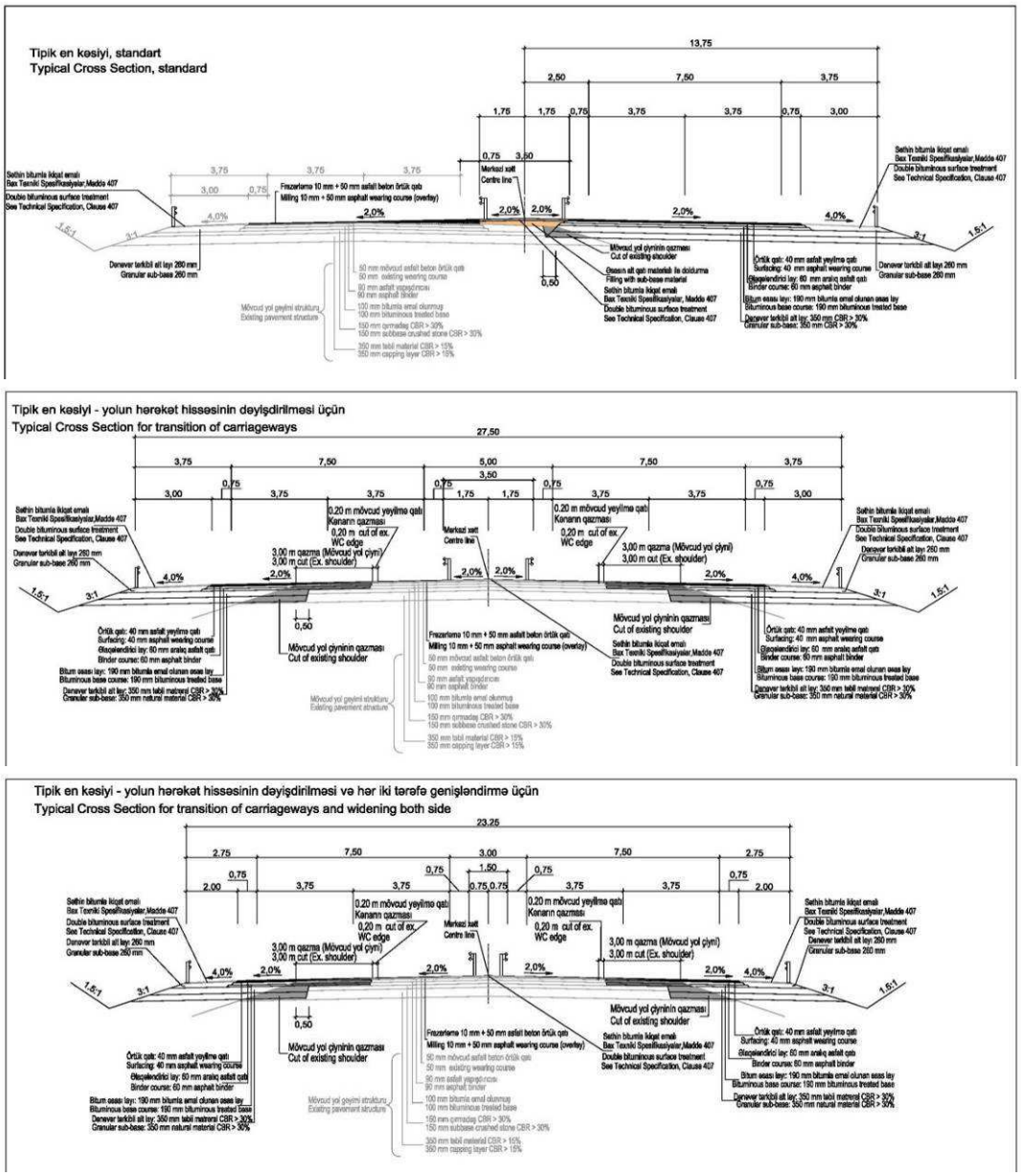
At km 121, the road approaching Muganli village is a single carriageway with shoulders on both sides. The road section passes through a rural area.

Proposed upgrading

The road will be upgraded to a new single carriageway following a new alignment which will improve the existing road geometry. Part of the new road will be constructed on a viaduct aiming at reducing landslide problems.

Figure 36- viaduct

Figure 37- Typical cross sections



7 RECOMMENDATIONS AND MITIGATION MEASURES

7.1 Measures of Environmental Prevention and Protection during the Construction Period

Together with this EIA Report the Environmental Management Plan and the Environmental Monitoring Plan hereto annexed, have been prepared along with the following EMPs for the Contractor:

- Emergency Reponse Plan for the construction phase;
- Construction Traffic Management Plan;
- Flora, Fauna and Re-forestation Plan;
- Material Management, Erosion Control and Reinstatement Plan;
- Noise Suppression Plan;
- Borrow Pit Management Plan;
- Waste Management Plan;
- Water Supply Management Plan;
- Location and Camp site Management plan.

Besides the Contractor shall be responsible for obtaining all the required licenses and permits.

7.1.1 Biological aspects

Control and Monitoring by national permanent specialists on site

Control over the execution of the work is of particular importance for the protection of the components of the flora - fauna and the ecological balance, and therefore it must be supported by an appropriate Environment Monitoring Plan (Annex 6).

In the area Mammals fauna includes: The threat *Barbastellabarbastella (*vulnerable species under 2008 IUCN Red List Category*)* and the *Rhinolophus blasii* (near Threatened Species under 2008 IUCN RLC). These animals can find shelters in surrounding structures during daytime and can be found in the study area throughout the year, except in the summer season. In particular the *Rhinolophus blasii* is found only in vicinity of Shamakhi forests. The mitigation measures for the species include: no dismantle works of structures can be performed without the prior field investigations and approval by the appropriate national specialists.

Reptil fauna includes: the protected Greek Tortoise *(Testudo graeca*) and the European Pond Turtle (*EmysOrbicularis*). The species bringing more concerns is the Greek Tortoise that in the winter season can be frozen in the soil. The mitigation measures for the species include: the wildlife specialists will check earth moving activities will move and shelter elsewhere all found tortoises.

The species of flora to be protected are that listed in the Red Data Book of Azerbaijan mentioned at chapter 4.1.1 above

It is clear that the involvement of national experts of the various environmental disciplines (zoologists, botanists, ecologists, hydro-biologist etc.) and of the competent regulatory authorities is absolutely necessary.

Road Components

Road Construction

Management practices to prevent and control impacts to terrestrial and aquatic habitats include:

- Possible techniques for terrestrial species may include wildlife underpasses, overpasses, bridge extensions, viaducts, enlarged culverts and fencing. The location of wildlife (mammals, amphibian and reptile fauna, listed in Paragraph 4.1.1.) underpasses has been confirmed in the detailed design of the sections n. 1 and 2.. Possible techniques for aquatic species include bridges, fords, open bottom or arch culverts, box and pipe culverts.
- Avoidance or modification of construction activities during the breeding season and other sensitive seasons or times of day to account for potentially negative effects.
- exploring opportunities for habitat enhancement through such practices as the placement of nesting boxes along the road, bat boxes underneath bridges, and preventing short and long term impacts to the quality of aquatic habitats by minimizing clearing and disruption of riparian vegetation; providing adequate protection against scour and erosion; and giving consideration to the onset of the rainy season with respect to construction schedules
- minimizing removal of native plant species, and replanting of native plant species in disturbed areas.

General Storm water Management

Practices applicable to roadways include the following:

- use of storm water management practices that slows peak runoff flow, reduces sediment load, and increases infiltration, including vegetated swales (planted with salt-resistant vegetation); filter strips; terracing; check dams; detention ponds or basins; infiltration trenches; infiltration basins; and constructed wetlands
- where significant oil and grease is expected, using oil/water separators in the treatment activities
- regular inspection and maintenance of permanent erosion and runoff control features.

Waste

The recommended prevention and control methods to reduce wastes include the following:

- operational design and planning should include procedures for the reduction of waste production (e.g. blending high-quality rock with poor rock)
- topsoil, overburden, and low-quality materials should be properly removed, stockpiled near the site, and preserved for rehabilitation
- hazardous and non-hazardous waste management plans should be developed and adopted during the design and planning phase (e.g. oily debris and contaminated soils recovered from lubricants or fuel spills, metal scraps, demolition materials). Impacts associated with specific chemical and/or physical properties of extracted materials should be considered

during the design phase, and impacts from waste rock impurities should be adequately controlled and mitigated by covering waste disposals with non-contaminated soil.

Materials Extraction

Dust emissions

For dust emissions, the recommended pollution prevention and control techniques should take the ecological and human toxicity of the dust into account and include:

- land clearing, removal of topsoil and excess materials, location of haul roads, tips and stockpiles, and blasting should be planned with due consideration to meteorological factors (e.g. precipitation, temperature, wind direction, and speed) and location of sensitive receptors
- a simple, linear layout for materials-handling operations to reduce the need for multiple transfer points should be designed and installed (e.g. processing plants should be preferably located within the quarry area)
- dust emissions from drilling activities should be controlled at the source by dust extractors, collectors, and filters, and wet drilling and processing should be adopted, whenever possible
- dust emissions from processing equipment (e.g. crushers, grinders, screens) should be adequately controlled through dust collectors, wet processing, or water spraying
- procedures to limit the drop height of falling materials should be adopted
- use of mobile and fixed-belt transport and conveyors should be preferred to hauling the material by trucks through internal roads (enclosed rubber-belt conveyors for dusty materials are recommended in conjunction with cleaning devices)
- internal roads should be adequately compacted and periodically graded and maintained
- a speed limit for trucks should be considered
- water spraying and surface treatment (e.g. hygroscopic media, such as calcium chloride, and soil natural–chemical binding agents) of roadways and exposed stockpiles using a sprinkler system or a "water-mist cannon" should be implemented
- exposed surfaces of stockpiled materials should be vegetated.

Hydrology

Surface water regimes may be altered because of flow diversions, water intake, and changes to the drainage pattern. Techniques to prevent minimize, or control impacts to the hydrologic regime caused by extraction activities include the following:

- quarry pond dredging activities should be designed and implemented to minimize drawdown with consideration of potential impacts to surface and groundwater resource flow and availability, including potential ecological impacts;
- storm water peak runoff rate should not exceed the peak predevelopment runoff rate for a particular design storm;
- reintroduction of treated, extracted water into streams to maintain the ecological flow;
- superficial infiltration of treated water to aquifers should be allowed. Alternatively, reinjection of treated water into the aquifers through injection wells or infiltration galleries may be implemented, provided potential groundwater contamination can be avoided;
- to the extent that it is consistent with the post-closure plan, a quarry pond should have a sufficient water depth to ensure the establishment of a stable aquatic ecosystem.

Waste

The recommended prevention and control methods to reduce wastes include the following:

- operational design and planning should include procedures for the reduction of waste production (e.g. blending high-quality rock with poor rock);
- topsoil, overburden, and low-quality materials should be properly removed, stockpiled near the site, and preserved for rehabilitation;
- hazardous and non-hazardous waste management plans should be developed and adopted during the design and planning phase (e.g. oily debris and contaminated soils recovered from lubricants or fuel spills, metal scraps, demolition materials). Impacts associated with specific chemical and/or physical properties of extracted materials should be considered during the design phase, and impacts from waste rock impurities should be adequately controlled and mitigated by covering waste disposals with non-contaminated soil.

Land Conversion

Excavation activities often involve topographical and land-cover changes to allow extraction activities, often including clearing of pre-existing vegetation. Techniques to minimize land conversion impacts include:

- vegetation translocation and relocation techniques should be used as necessary. Vegetation cover, such as native local plants, topsoil, overburden, or spoils feasible for sustaining growth should be removed in separate operations and segregated for later use during site reinstatement, and materials to be used for site reinstatement should be stockpiled and protected from wind and water erosion, as well as from contamination;
- during reinstatement, affected land should be graded and appropriately scarified before soil layers are reapplied, sustaining vegetative re-growth where needed (the combined thickness of topsoil and the growth layer should not be less than that prevailing in the undisturbed areas);
- during extraction, ecological niches should be preserved and protected as far as possible
- selection of appropriate low-impact extraction (e.g. excavation, quarrying, and dredging) methods that should result in final site contours supportive of habitat restoration principles and final land use;
- establishment of buffer zones from the edge of extraction areas, considering the characteristics of the natural habitats and the type of extraction activities;
- to reduce the consumption of land area and, consequently, the loss of soil, preference for extraction should be given to thicker deposits (these should be exploited as far as possible and as reasonable);
- smaller, short-lived extraction sites should be reclaimed immediately, and larger sites with a useful lifespan beyond 3–5 years should be subject to ongoing rehabilitation;
- affected land should be rehabilitated to acceptable uses consistent with local or regional land use plans. Land that is not restored for a specific community use should be seeded and re-vegetated with native species;
- test pits, interim roads (internal and access), buildings, installations, and structures of no beneficial use should be removed, and the land should be appropriately rehabilitated. Hydrological systems should be restored to predevelopment runoff rate. Opportunities to create ecologically valuable habitats should be considered (e.g. small lakes and pools with a complex shoreline and shallow water zones, after dredging or areas for natural succession).

Water

Storm water Resource Protection

From exploration onwards, management strategies include:

- reducing exposure of sediment-generating materials to wind or water (e.g. proper placement of soil and rock piles);
- divert run-off from undisturbed areas around disturbed areas including areas that have been graded, seeded, or planted. Such drainage should be treated for sediment removal
- reducing or preventing off-site sediment transport (e.g. use of settlement ponds, silt fences);
- storm water drains, ditches, and stream channels should be protected against erosion through a combination of adequate dimensions, slope limitation techniques, and use of rip-rap and lining. Design requirements for temporary drainage structures should additionally be defined on a risk basis considering the intended life of diversion structures, as well as the recurrence interval of any structures that drain into them.

From construction onwards, recommended management strategies include:

- establishing riparian zones;
- timely implementation of an appropriate combination of contouring techniques, terracing, slope reduction/minimization, runoff velocity limitation and appropriate drainage installations to reduce erosion in both active and inactive areas;
- access and haul roads should have gradients or surface treatment to limit erosion, and road drainage systems should be provided;
- facilities should be designed for the full hydraulic load, including contributions from upstream catchments;
- storm water settling facilities should be designed and maintained according to internationally accepted good engineering practices, including provisions for capturing of debris and floating matter. Sediment control facilities should be designed and operated for a final Total Suspended Solids (TSS) discharge of 50 mg/l and other applicable parameters and guideline values in Section 2.0, taking into consideration background conditions and opportunities for overall improvement of the receiving water body quality, as discussed in the General EHS Guidelines. Discharge water quality should also be consistent with the receiving water body use.

From operations onwards, recommended management strategies include:

- final grading of disturbed areas, including preparation of overburden before application of the final layers of growth medium, should be along the contour as far as can be achieved in a safe and practical manner;
- re-vegetation of disturbed areas including seeding should be performed immediately following application of the growth medium to avoid erosion.

Groundwater Resource Protection

Leaching: Operators should design and operate surface heap leach processes with:

- infiltration of toxic leach solutions (hydrocarbons, mineral oils and all typologies of chemicals compounds present in the concrete, etc.) should be prevented through the provision of appropriate liners and sub-drainage systems to collect or recycle solution for treatment, and minimize ground infiltration
- pipeline systems carrying pregnant solutions should be designed with secondary bundled containment;

- leak detection equipment should be installed for pipeline and plant systems with appropriate leak response systems in place;
- process solution storage ponds and other impoundments designed to hold non-fresh water or non-treated leach process effluents should be lined, and be equipped with sufficient wells to enable monitoring of water levels and quality.

Decommissioning

The Baku-Shamaki project will involve both the use of existing and new borrow pits. The quantity of excavated material required for the project has been estimated in the design for the sections n. 1 and 2 (between km 45+000 and 67+500 and between km 67+500 and 91+000). Site reclamation and closure activities have to be considered during the early phases of the planning and design process.

Contractors should prepare a reclamation and closure plan that considers factors such as production phasing and overall site life, but all sites will need to engage in some form of progressive restoration during operations. While plans may be modified, as necessary, during the construction and operational phases, plans should include contingencies for temporary suspension of activities and permanent early closure and meet the following objectives:

- *Chemical Integrity*: Surface water and groundwater should be protected against adverse environmental impacts resulting from excavation and processing activities. Leakages of chemicals into the environment should not endanger public health or safety or exceed water quality objectives in downstream surface water and groundwater systems.
- *Ecological Habitat Integrity*: While ecological habitat integrity is partially determined by the above factors (e.g., physical issues such as slope stability) and chemical issues (e.g., such as metal contaminants), it is also addressed with consideration towards replacement of habitat that is beneficial for future ecological use.

From construction onwards, recommended management strategies include:

- Establishing riparian zones;
- timely implementation of an appropriate combination of contouring techniques, terracing, slope reduction /minimization, runoff velocity limitation and appropriate drainage installations to reduce erosion in both active and inactive areas
- access and haul roads should have gradients or surface treatment to limit erosion, and road drainage systems should be provided
- facilities should be designed for the full hydraulic load, including contributions from upstream catchments
- storm water settling facilities should be designed and maintained according to internationally accepted good engineering practices, including provisions for capturing of debris and floating matter. Sediment control facilities should be designed and operated for a final Total Suspended Solids (TSS) discharge of 50 mg/l and other applicable parameters and guideline values, taking into consideration background conditions and opportunities for overall improvement of the receiving water body quality. Discharge water quality should also be consistent with the receiving water body use.

From operations onwards, recommended management strategies include:

- final grading of disturbed areas, including preparation of overburden before application of the final layers of growth, should be along the contour as far as can be achieved in a safe and practical manner

- re-vegetation of disturbed areas including seeding should be performed immediately following application of the growth layer to avoid erosion.

Land Use and Biodiversity

Integrating conservation needs and development priorities in a way that meets the land use needs of local communities is often a critical issue for road projects.

Recommended strategies include consideration of the following:
- whether any critical natural habitats will be adversely impacted or critically endangered or endangered species reduced
- whether the project is likely to impact any protected areas
- the potential for biodiversity offset projects (e.g. proactive management of alternative high biodiversity areas in cases where losses have occurred on the main site due to the prohect development) or other mitigating measures
- whether the project or its associated infrastructure will encourage immigration, which could adversely impact biodiversity and local communities
- consideration of partnerships with internationally accredited scientific organizations to, undertake biodiversity assessments, conduct ongoing monitoring, and manage biodiversity programs
- Consultation with key stakeholders (e.g. government, civil society, and potentially affected communities) to understand any conflicting land use demands and the communities dependency on natural resources and/or conservation requirements that may exist in the area.

Terrestrial Habitats

Temporary and permanent terrestrial habitat alteration should be minimized to the extent feasible and be consistent with the requirement to protect and preserve critical habitat.

Recommended management strategies include:
- sitting access routes and facilities in locations that avoid impacts to critical terrestrial habitat, and planning exploration and construction activities to avoid sensitive times of the year
- minimizing disturbance to vegetation and soils
- implementation of mitigation measures appropriate for the type of habitat and potential impacts including, for example, post-operation restoration (which may include baseline inventories, evaluations, and eventual rescue of species), offset of losses, or compensation of direct users
- avoiding or minimizing the creation of barriers to wildlife movement, or threats to migratory species (such as birds) and providing alternative migration routes when the creation of barriers cannot be avoided
- planning and avoiding sensitive areas and implementing buffer zones
- conducting activities such that the risk of landslides, debris or mud flows, and bank or alluvial fan destabilization is minimized
- implementing soil conservation measures (e.g. segregation, proper placement and stockpiling of clean soils and overburden material for existing site remediation); key factors such as placement, location, design, duration, coverage, reuse, and single handling should be considered

- where topsoil is pre-stripped, it should be stored for future site rehabilitation activities. Topsoil management should include maintenance of soil integrity in readiness for future use. Storage areas should be temporarily protected or vegetated to prevent erosion
- conserving the quality and composition of growth medium for use (e.g. for capping) during site reclamation and closure activities
- ensuring that the growth medium is sufficient to support native plant species appropriate for the local climate and consistent with proposed future land uses. Overall thickness of the growth medium should be consistent with surrounding undisturbed areas and future land use
- manage vegetation growth along access roads and at permanent above-ground facilities. Remove invasive plant species and replant native species. Vegetation control should employ biological, mechanical and thermal vegetation control measures and avoid the use of chemical herbicides as much as possible.

If the use of herbicides is demonstrated to be necessary to control vegetation growth along access roads or for facilities, then personnel should be trained in their use. Herbicides that should be avoided include those listed under the World Health Organization (WHO) recommended Classification of Pesticides by Hazard Classes 1a and 1b, the WHO recommended Classification of Pesticides by Hazard Class II.

Aquatic Habitats

Earth-moving operations may mobilize sediment which can enter watercourses and disrupt water quality and quantity. Recommended management strategies include the following:

- minimizing the creation and extent of new access corridors
- decommissioning and re-vegetating exploration access routes, and installing barricades to limit access
- maintaining, to the extent possible, natural drainage paths and restoring them if they are disrupted
- maintaining water body catchment areas equal or comparable to pre-development conditions
- protecting stream channel stability by limiting in-stream and bank disturbance, and employing appropriate setbacks from riparian zones
- attenuating surface runoff from high precipitation events using on-site storage and water management infrastructure (e.g. storage ponds, sumps, low gradient ditches, clean water diversions)
- designing temporary and permanent bridges and culverts to manage peak flows depending on the associated potential risk
- constructing, maintaining, and reclaiming watercourse crossings that are stable, safe for the intended use, and that minimize erosion, mass wasting and degradation of the channel or lake bed.

Dust

Dust emissions from the dry surfaces of tailings facilities, waste dumps, stockpiles and other exposed areas should be minimized. Recommended dust management strategies include:

- dust suppression techniques (e.g. wetting down, use of all weather surfaces, use of agglomeration additives) for roads and work areas, optimization of traffic patterns, and reduction of travel speeds
- exposed soils and other erodible materials should be re-vegetated or covered promptly

- new areas should be cleared and opened-up only when absolutely necessary;
- surfaces should be re-vegetated or otherwise rendered non-dust forming when inactive
- storage for dusty materials should be enclosed or operated with efficient dust suppressing measures
- loading, transfer, and discharge of materials should take place with a minimum height of fall, and be shielded against the wind, and consider use of dust suppression spray systems
- convey or systems for dusty materials should be covered and equipped with measures for cleaning return belts.

Borrow pits closure and post-closure (decommissioning)

A closure plan that incorporates both physical rehabilitation and socio-economic considerations should be an integral part of the project life cycle and should be prepared so that:

- future public health and safety are not compromised
- the after-use of the site is beneficial and sustainable to the affected communities in the long term
- adverse socio-economic impacts are minimized and socioeconomic benefits are maximized.

The plan should address beneficial future land use previously approved by the relevant national authorities, and should be the result of consultation and dialogue with local communities and their government representatives. The same plan should include information on the site conditions at the end of the extraction activity such as the presence of equipment, etc.

Records of the extraction works should also be maintained as part of the post-closure plan. Closure and post closure plans should include appropriate aftercare and continued monitoring of the site, pollutant emissions, and related potential impacts. The duration of post closure monitoring is defined on a risk basis. The preparation of closure and post-closure plans are responsibilities of the construction contractor, as well as obtaining the Client's approval for both plans.

7.1.2 Geological aspects

At this stage the exact location of the work sites and the sequence of construction phases are not identified. This will be defined during the construction phase when the contractor will have to implement a specific Environmental Management Plan. Therefore, mitigation measures have been provided on the basis of the experience for similar road projects and include the following measures.

All concentrated water flows shall be channelled away from disturbed soil areas. Concentrated water flows shall be conveyed in such a way to prevent soil erosion.

Squirting water used on construction roads, sites pavements and at crushing plants to prevent dust emissions should be screened.

Remedial measures should be adapted to avoid severe impacts on local hydrological environment areas susceptible of erosion, such as steep slopes, minimizing the number of water crossings wherever possible and using only clean fill materials around the few

watercourses encountered along the corridor; leaving buffer zones of undisturbed vegetation (width increased in proportion to slope) between road sites and watercourses.

Sections of dirt and gravel roads prone to erosion and likely to be a source of sediment can be paved to reduce the amount of sediment produced. This is especially relevant near water crossings.

Increased water runoff and erosion from various parts of the road may potentially result in siltation of downstream water courses and drainage systems. To minimize this effect, the following mitigation measures are recommended:

- sediment control and attenuation facilities such as sand traps, temporary attenuation ponds and soak-away will be used as necessary during construction to protect the site, adjacent areas and the downstream drainage systems
- stock-pile areas for materials such as sand, gravel, stone, and topsoil, as well as overburden dumps should be located away from water courses and will be surrounded by perimeter drains with sediment and other pollutant traps located at drain exits.

Stabilizing a slope to eliminate possible flow-slide, the surface layers should be stripped and replaced with dry and well compacted fill. A drainage system is also required between old and re-compacted fill to prevent development of water pressure behind the filled zone.

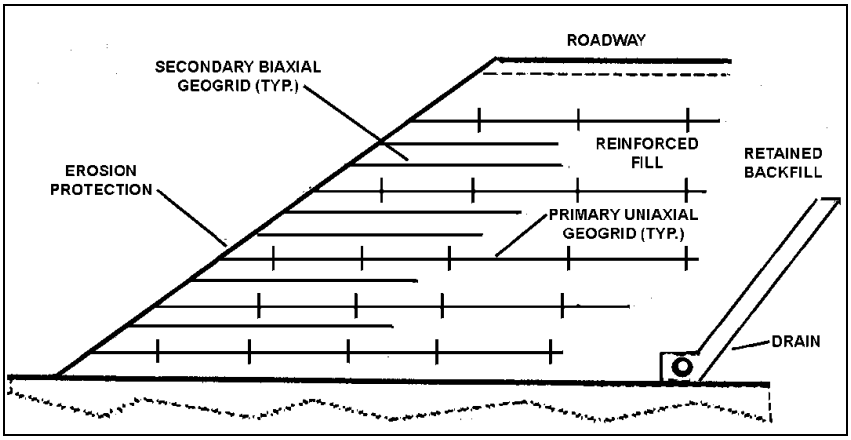
The operation of re-profiling of a slope with the aim of improving its stability can be achieved through geometry modification. A typical procedure is lowering the slope and positioning infill at the foot of the slope and after geotechnical investigations, providing suitable retaining structures, if necessary.

The most prominent use of mechanically reinforced earth can be used for widening and reconstruction of the existing road. The use of reinforced steepened slopes to widen the project road improves mass stability, reduces fill requirements and eliminates additional crossings.

The principle components of reinforced or mechanically stabilized earth embankments are schematically shown in Figure 38.

Reinforcements in the fill soil create a structurally stable composite mass. These main tensile elements are referred to as primary reinforcement. Shorter, intermediate inclusions may be placed near the slope face. These secondary reinforcing elements are used to minimize sloughing or face sliding and to aid the compaction and alignment control. The soil at the outer edge of the slope may also be faced with some kind of netting (e.g., coir or jute) to prevent or minimize soil erosion.

Figure 38- Material and structural components of a typical, reinforced steepened slope



Live cut brush layers can be used as the secondary reinforcement or, in some cases, as both secondary and primary reinforcements.

This approach which is termed soil bioengineering entails the use of living vegetation, primarily cut woody plant material that is purposely arranged and embedded in the ground in selected patterns and arrays to prevent superficial erosion and arrest shallow mass movement.

Brush layering consists of inserting live, cut branches or brush between successive layers of compacted soil as shown in Figure 39, Figure 40 and Figure 41. This process works best when applied in conjunction with the construction of a fill slope. The tips of the branches protrude just beyond the face of the fill where they intercept rainfall, slow runoff and fitter sediment out of the slope runoff. The stems of the branches extend back into the slope in much the same manner as conventional, inert reinforcements, e.g., geo-textiles and geo-grids, and act immediately as tensile inclusions or reinforcements.

Figure 39- Hedge with cuttings

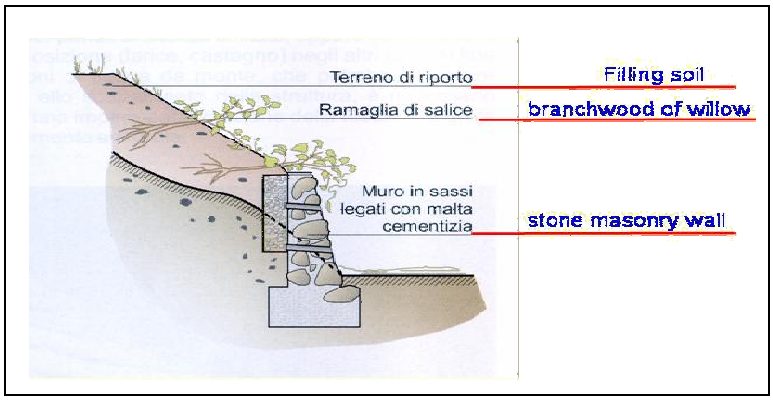


Figure 40- Timber grating with cuttings

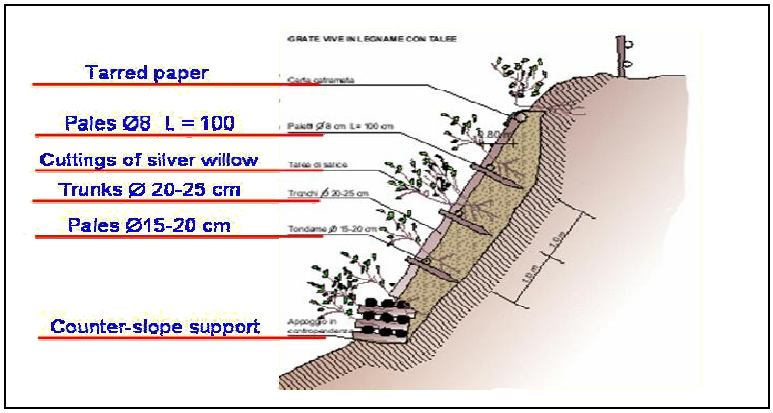
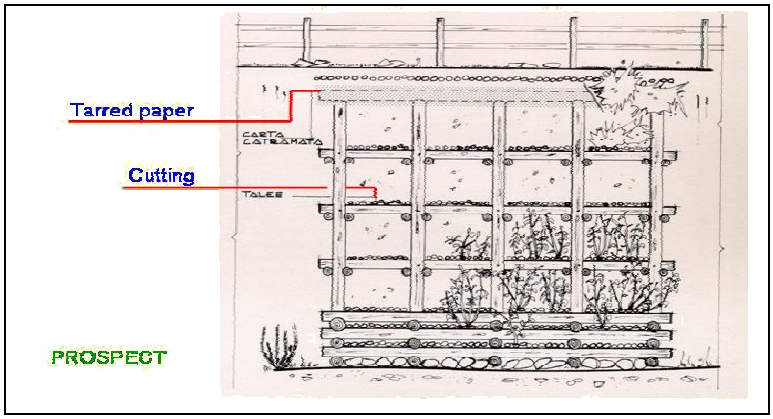


Figure 41- Timber grating with cutting (Prospect)



Also the construction site should be realized in an area large enough to allow the planned activities so that to reduce the potential environmental interferences with the neighbourhood. The site must be positioned in the vicinity of the working area in order to easily reach the place of assembly in order to reduce as far as possible on the means of transportation vehicles.

7.1.3 Socio economic aspects

For the social and economic wellbeing during the construction phase, few but important mitigation measure must to be assured:

- in all the urban areas a road police agent during the working hours have to be constantly present to avoid any conflict between pedestrian, local and throughout traffic, equipment and working vehicles
- the working hours must be respected to let the resident people rest during the night time, holidays, religious and social occasion
- ban any stallholders within a range of 100 m from construction site
- provide night/day horizontal and vertical signals to advert the presence of the construction site, working vehicles and any other potential dangerous substance/equipment.

7.1.4 Air and noise mitigation measures

Air

The air quality can be affected by particle emissions during construction works, batch plants operations and traffic.

It is recommended to use during the works only equipment and means of transport that have diesel engines that produce very little carbon monoxide and no Pb emissions. Construction machinery must be well maintained to minimize excessive gaseous emission.

Traffic speed should be restricted and application of water or other dust suppressants should be applied to the road at regular intervals (in the urban areas the use of bumps is recommended). Soil stabilization with lime should be carried out within site management facility.

To control the powders inside the construction site areas, in the presence of human receptors, continuous panels of h = 2.00/2.50 m could be adopted, if deemed appropriate.

Noise

In terms of general request related to the mitigation measures, contractors shall be required to limit the activities producing excessive noise levels (work in borrow pits and quarries) to the working days and to the daytime. The equipment that normally creates high levels of noise should be suppressed or protected when working within a distance of 200 m from any human settlement or religious building.

About the reduction of potential noise impacts during the construction phase, the Consultant proposes the following measures:

- the itinerary of the transport track must be carefully studied in order to avoid as much as possible noise and vibration disturbances and then strictly respected
- in particular the dumpers must be operating as far as possible from the existing human settlements
- Plant and equipment for crushing, asphalt,etc. must be developed at distances higher than 200 m from populated areas and works should be undertaken only during the day (6 a.m.–10 p.m.) or screened by anti – noise barriers
- the planning of the activities in the construction site should be studied with a view to isolate the noisy ones
- the stocking of materials in the construction site should be made in such a way to act as a noise barrier protecting the settlements
- the noise absorption system provided for the machinery should be regularly maintained.

7.2 Measures of Environmental Prevention and Protection during the Operation Period

7.2.1 Biological aspects

Road Resurfacing

- Maximize the rate of recycling of road resurfacing waste either in the aggregate (e.g. reclaimed asphalt pavement or reclaimed concrete material) or as a base course;

- Incorporate recyclable materials (e.g. glass, scrap tires, certain types of slag and ashes) to reduce the volume and cost of new asphalt and concrete mixes.

Road Maintenance

Management practices to prevent minimize, and control impacts from road maintenance include:

- implementation of integrated vegetation management (IVM); from the edge of the carriageway along the road corridor, vegetation includes small plants near the road and larger trees further away which provide the habitat for a wide variety of plants and animals
- planting of native species and removal of invasive plant species
- use of biological, mechanical, and thermal vegetation control measures where feasible, and avoid use of chemical herbicides
- use only herbicides that are produced in accordance with international standards and norms, such as the FAO Revised Guidelines for Good Labelling Practice for Pesticides
- training personnel to apply herbicides and ensure that personnel posses certifications or equivalent training if certifications are not required in compliance with international restrictions and regulations on pesticide use
- application of herbicides based on criteria (e.g. field observations, weather data, time of treatment, and dosage) and drafting of a pesticide logbook to record such information
- selection of application technologies and practices designed to reduce unintentional drift or runoff
- establishment of untreated buffer zones or strips along water sources, rivers, streams, ponds, lakes, and ditches to help protection of water resources
- contamination of soils, groundwater, or surface water resources, due to accidental spills during transfer, mixing, and storage of herbicides. Accidents should be prevented by following the hazardous materials storage and handling management practices.

Other Wastes

- collect road litter or illegally dumped waste and manage it according to the previous recommendations. Provision of bottle and can recycling and trash disposal receptacles at parking lots to avoid littering along the road
- manage herbicide and paint inventories to avoid accumulation of large quantities of unused product. Obsolete product should be managed and disposed as hazardous wastes as described in the General EHS Guidelines
- collect animal carcasses in a timely manner and disposing them through prompt burial or other environmentally safe methods
- recycle vegetation waste for reuse as a landscaping fertilizer
- manage sediment and sludge removed from storm drainage systems maintenance activities as hazardous or non-hazardous wastes based on an assessment of their characteristics.

Painting Activities

- management of all removed paint materials suspected or confirmed of containing lead as hazardous wastes
- implementation of a system to collect paint waste when removing old paint containing lead. For a simple scraping operation, ground-covering tarps may be sufficient. For a

blasting operation, an enclosure with a negative pressure ventilation system may be necessary
- grinding of removed, old road surface material and re-use in paving, or stockpiling the reclaim for road bed or other uses. Old, removed asphalt may contain tar and polycyclic aromatic hydrocarbons and may require management as a hazardous waste.

Road De-icing

Cold climates may require the removal of snow and ice. Recommendations for this aspect include:
- primary use of mechanical de-icing methods (e.g. sweepers and ploughs), integrated with chemical means if necessary
- pre-treating of pavement surfaces with anti-icing methods prior to the fall of snow or ice formation to reduce the need for subsequent applications and to allow easy removal
- selectively applying anti-icing and de-icing agents based on expected pavement temperatures and the use of road weather information system
- training employees in the application of anti-icing and de-icing agents at optimum rates and times, and routinely calibrating de-icer application equipment
- select the type of anti-icing and de-icing agents based on the location of environmentally sensitive areas and the potential impacts of the particular agent
- design roads and bridges to minimize the accumulation of drifting snow on the roadway
- design drainage and site reinstatement to minimize impacts of anti-icing and de-icing agent runoff to surface water and vegetation.

7.2.2 Geological aspects

The mitigation measures, that should be applied to reduce impacts of the road construction on soil during the construction period, depend on site and project specific conditions. These impacts are related to the project activities such as land disturbance, erosion and the extraction of raw materials for the project.

The stability of slopes must be evaluated utilizing pertinent geological information regarding engineering properties of the soil along the road.

In evaluating engineering properties of soil and rock materials, particular consideration must be given to the possible variation of natural deposits or borrow materials, natural water contents of the materials, climatic conditions, possible variations in rate and methods of fill placement, in placement water contents and compacted densities that must be expected with normal control of fill construction.

Another important factor in terms of environmental protection is the spillage of fuel, oil and other liquids which have the potential to cause contamination of soil and groundwater.

The Contractor shall implement measures to contain such leakages and avoid contamination as much as possible. However, it is possible that some contamination may occur and the Contractor will be required to implement remediation measures in accordance with project and the specified requirements. Fuel and oil storage tanks will be located at a distance of 50 m from any watercourse, well or dry river bed. Wherever possible, re-fuelling and maintenance of mobile plants (if used) will be carried out at minimum 50m from watercourses/water bodies, dry river beds, while such operations will be prohibited within designated wetlands and aquifers.

7.2.3 Socio economic aspects

The enlargement and upgrading of the Baku-Shamakhi road will have a socio economic impact requiring environmental protection measures for urban areas and their surroundings, as well as for junctions and interchanges along the whole corridor.

Such measures include:

- Round-about at the beginning of each "urban centre" crossed by the new alignment (Dzhangi, Narimakand- Maraza, Sabir and Shamakhi)
- A third lane in Dzhangi with appropriate sidewalks and bike lane especially on the east side where the village enlargement is undergoing and a lot of shops and artisan workshops are localized
- A third lane in Maraza and Sabir on both the carriage way for pedestrian with appropriate sidewalks and bike lane to support the local commerce along the road in safety conditions;
- speed limit signal at 50 Km/h and 30 km/h near schools, bus stop, mosques and hospitals, medical and health centres
- VCD (video-cam recorder) for speed violation record
- flash speed alert before each pedestrian crossing
- rumble stripes at the beginning of the urban areas and 30 mt and 15 mt before pedestrian crossing (and roundabout)
- horizontal pedestrian crossing signal and illuminated islands between the lanes and "Led lights" signs combined with white strips during the night hours
- noise reduction asphalt
- dedicated safety and warning signals (children crossing, mosque, church, schools, hospitals and medical centres, tourist destination, police and public buildings)
- lights every 25 m in all the urban sections on both directions and flash lights during the night and in case of fog, rain and snow
- emergency call equipment (1 station every km) on both directions
- police surveillance during the daily peak hours
- pedestrian safety islands between the two carriageways
- Architect/Urban designer working together with road engineers to prepare detailed design for road ancillary works

7.2.4 Air and noise aspects

Air

The mitigation measures required during the construction phase relate mainly to the application of appropriate public safety measures.

Noise

Noise reduction can be achieved through different approaches:

- reduction of noise transmission through the installation of sound barriers
- reduction of noise emissions at source (vehicles, road pavement)
- reduction of noise impact in sensitive areas such as residential areas through the individual installation of noise prevention windows.

The barriers, high not less than 3 m, can reduce the noise transmission by 6 - 15 dB depending on the location. The sound-absorbing asphalt can reduce the noise level by 2 dB (normal) to 6 dB (special). High quality noise prevention windows can reduce the noise level by 30 - 45 dB.

It has been estimated that the installation of noise protection barriers close to the borders of the two main villages crossed by the road may reduce the noise level from the value of 70– 75 dBA (value that can be reached at the edge of the road in normal traffic conditions, see Table 11 to Table 13 at page 73) to a more acceptable value of 60 – 65 dBA.

Noise prevention barriers should be installed at Narimankand (on the left side of the road for about 1.1 Km, all along the external border of the town) and at Maraza (on the right of the road for about 0.6 Km, just before the entrance of Roundabout 3).

In these specific cases, the noise protection barriers will not produce any remarkable effect of severance for the local communities, being the alignment of the road on the edge of the towns in both cases. If the actual noise levels inside the houses remain outside the permitted limits, the noise prevention may be supplemented with the installation of noise prevention windows, to be evaluated case by case on the bases of punctual noise measurements performed during the operation of the new road.

Along the section between km 45+000 and 91+000, noise effects will have an impact mainly on isolated houses (with a partial exception for Dzhangi area). This impact can be mitigated by the use of noise prevention windows (to be applied to those buildings falling in the corridor 250 m wide on each side of the road, namely the area in which direct impacts are expected). It is understood that further analysis will have to be performed after the construction of the road in order to measure the actual level of noise and to address specific interventions. During the analysis particular attention should be paid to the sensitive buildings listed in Table 14 and Table 15 at page 74. For all these buildings it is recommended the installation of noise reduction windows). Local residents have been made aware of the problem and of the suggested mitigation measures during surveys and public consultations. They were in general well-disposed towards the proposed measures; however they expect that the implementation of such measures will have no cost impact for residents.

On the other side, reduction of noise can be achieved through the creation of green screens with shrubs and trees and other ancillary works generally known as "urban design", or "street design". Such interventions allow the same time the improvement of the urban landscape, particularly important especially for Maraza, Narimakand and Sabir villages.

It should be noted that in Sabir the entrance to the old city centre is characterized by a statue and a portal with a triumphal arch where people usually meet all day. Since here a bypass is not expected, the risk is that the new upgraded alignment makes impossible the access to the old city center and compromises the relations between Sabir West (old town) and Sabir East (new settlements). That is the reason why in all the urban city centers where a bypass is not provided and the road enlargement goes through, it is strongly suggested to combine together road design, urban landscape design, and safety road and traffic calming measures (for both pedestrians, vehicles and cyclist), aiming at the same time to improve life quality, safety condition and local urban identity. This observation is specially referred to the final part of the alignment (between km 91+000 and 121+000). For this section the detailed design is still not available and there are two settlements crossed by the road (the aforementioned Sabir and Shamaki). On the other side, the settlements that are between km 45+000 and 91+000 are interested by the road only at their margins (Dzhangi, Narimankand, Maraza) and therefore do not belong to this category.

Nevertheless, for section three (beyond Km 91+000) the available information on the alignment allowed the consultant to make a preliminary verification on the impact of noise on the involved areas and to provide appropriate mitigations and prevention measures. Such measures will have to be duly taken into account while developing the detailed design for noise, urban-escape and ancillary works dedicated to road safety in this section.

The introduction of special silent pavement inside the urban areas can be also evaluated as an additional measure to reduce the noise pollution. This option will have to be carefully verified in advance in terms of compatibility with the local weather conditions., Before proceeding with this additional measures, some short "test sections" may be implemented in order to verify the compatibility of these pavements with the local weather conditions. If found feasible, such measure can be adopted in a second phase, when an overhaul of the road pavement conditions is necessary. It is clear that, this solution is an additional option and not a compulsory measure.

7.3 Capital Assessment of Environmental Protection Measures

According to the capital estimate of mitigation measures for the environmental impact, the investment in the environmental protection and further primary safety can be primarily calculated as the 3% of the total investment cost.

7.4 Recommendations to be incorporated in road design

Social safety and security aspects:

- Round-about at the beginning of each "urban centre" crossed by the new alignment (Dzhangi, Narimankand- Maraza, Sabir and Shamakhi)
- Where the road urban section is wide enough, to include a third lane on each side for local traffic and mobility along with appropriate sidewalks and bike lanes (especially in Dzhangi, Maraza, Sabir)
- 50 Km/h and 30 km/h speed limit signals at near schools, bus stop, mosques and hospitals, medical and health centres
- VCD (video-cam recorder) for speed violation record
- flash speed alert before each pedestrian crossing
- rumble stripes at the beginning of the urban areas and 30 m and 15 m before pedestrian crossing (and roundabout)
- horizontal pedestrian crossing signal and illuminated island between the lanes and "Led lights" signs combined with white strips during the night hours
- noise abatement asphalt
- dedicated safety and warning signals (children crossing, mosque, church, schools, hospitals and medical centres, tourist destination, police and public building)
- lights every 25 m in all the urban sections on both direction and flash lights during the night and in case of fog, rain and snow
- emergency call equipment (1 station every km)on both directions
- police surveillance during the daily peak hours
- pedestrian safety islands between the two carriageways

- Architect/Urban designer working together with road engineers to prepare detailed design for road ancillary works
- Avoid pedestrian overpasses
- Provision of acceleration and deceleration lanes at the intersections between local roads and M4 in order to avoid the collision risk between the vehicles on the main road and the connecting ones
- Replace U-turn intersections by roundabouts systems to allow users manoeuvring as needed
- Provision of noise prevention barriers at Narimankand (on the left side of the road for about 1.1 Km, all along the external border of the town) and at Maraza (on the right of the road for about 0.6 Km, just before the entrance of Roundabout 3). Reduction of noise can be achieved also through the creation of green screens with shrubs and trees and other ancillary works generally known as "urban design", or "street design".
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Wildlife crossing:

- 1 underpass for crossing of domestic animals every 5 km or in the proximity of usual crossing points and/or grazing lands and temporary shelters for domestic animals.
- 1 underpass for crossing of wildlife animal every 10 km or where migration routes of local wildlife are identified.
- For prone to erosion soil and landslide provide proper protection.

Recommendations include use of geotechnical engineering technologies for the stabilization of soil prone to erosion as well as for the prevention of landslides. Appropriate hydraulic techniques for the channelization of rain and superficial water to avoid erosion are also strongly suggested.

8 ENVIRONMENTAL MANAGEMENT PLAN

8.1 Objective and purpose of the environmental management plan

The environmental management plan has the following objectives:

- protection of the environment from potentially harmful road and related activities, and vice versa
- enhancement of road attributes, especially in regard to the integrated local development
- governmental institutional strengthening in conducting environmental protection and monitoring.

These objectives can be achieved through the following:

- AzerRoad Service, MOT and Ministry of Environment (MOE) leading a small environmental team
- contract requirements for environmental protection to be implemented during the construction of the road
- mitigation of the anticipated drawbacks associated with the road works

A separate report (Annex 8) contains the detailed Environmental Management Plan (EMP) together with the implementation measures and the monitoring plan. In addition, a number of construction EMPs have been prepared for use by the Contractor:

- Flora, Fauna and Reforestation Plan – EMP1
- Borrow Pit Management Plan – EMP2
- Water Supply Management Plan – EMP3
- Noise Suppression Plan – EMP4
- Construction Traffic & Access Management Plan – EMP5
- Material Management & Erosion Control Plan – EMP7
- Emergency Response Plan – EMP8
- Waste Management Plan – EMP9
- Location and Campsite Management Plan – EMP10

These documents can be found in Annex 9 – 17.

9 MONITORING PLAN

9.1 Measures and Recommendations

Environmental Monitoring

Environmental monitoring programs for this sector should be implemented to address all activities that can have a significant impact on the environment during normal operations and exceptional conditions. Environmental monitoring activities should be based on direct or indirect indicators of emissions, effluents, and resource use applicable to the particular project. Monitoring should be conducted by trained individuals following monitoring and record-keeping procedures and using properly calibrated and maintained equipment. Monitoring data should be analysed and reviewed at regular intervals and compared with the operating standards so that any necessary corrective actions can be taken. Additional guidance on applicable sampling and analytical methods for emissions and effluents is provided in the General EHS Guidelines.

9.1.1 Geological aspects

As it is normal for an EIA study, this report does not include a detailed evaluation of methods for slope stability analysis. This task has to be more appropriately performed during the design development, when further geotechnical/geological investigations are carried out and more data are available. Nevertheless, the Consultant, upon request of the Client has developed and submitted in February 2013 an additional report on "Engineering-geological conditions of the landslide areas between km 103 and 111 of Baku-Shamakhi road" (Annex 7). This report as well as all the information and recommendations included in the present EIA report have made the designer aware of the major factors affecting the slope stability and of the effects that they may have on the new road.

The following recommendations are to ensure that the road geometry and the road surface drainage are appropriate to the terrain and that road surface is consistent with the road drainage structures. Interceptor ditches or berms to direct runoff away from erodible areas. V-lined ditches with paved shoulders on the inner side of the curve should be proposed. The key to solving erosion issues is the control of the speed and infiltration of storm water because the area is susceptible of surface erosion, especially after heavy rains. Therefore, efforts will be made to reduce the potential soil erosion during construction activities. Temporary berms will be constructed where necessary to control the runoff to prevent rills or gullies forming or soil wash out to surface water receptors. Correct ground works and compaction will be specified in the contract documentation to prevent soil erosion. The contractor will be also required to design a reinstatement plan.

In order to prevent high erosion or landslide hazard a qualified specialist has to be consulted during the design of the road sections crossing sensitive areas.

There are places where a simple solution is possible using reinforced shotcrete with satisfactory results, with reasonable costs and often with a significant reduction of

construction time. The use of shotcrete for slope stabilization and homogeneously reinforced concrete with excellent density and impermeability prevents the formation of water seepages.

Vegetation/grass on the slopes also contributes to erosion control. But, growth must be checked and controlled. Permanent erosion control is considered functional when more than 70 percent of the vegetation is established.

Finally, as far as the alteration of the natural topography by the widening of the road, this is a permanent impact on the landscape that can be mitigated, especially in urban areas, by the installation of green shields along the alignment.

9.1.2 Air & Noise

A monitoring plan has been developed to determine the effectiveness of mitigation and to verify predictions and comply with the local environmental laws. The monitoring system should be outlined to determine whether mitigation actions have been implemented as scheduled and are working as expected.

This monitoring plan consists of:

- Measures for survey of noise levels and pollution near sensitive receivers along the M4 and local existing routes during the operation years (at least each year, during working days and weekends)
- traffic counts to estimate traffic flows and speeds on the M4 road and local road network (at least each year, during working days and weekends)

These issues are necessary to appraisal the best mitigations measures along the alignments during the operation years.

A separate report contains the detailed Environmental Management Plan together with the implementation measures and the monitoring plan.

10 PUBLIC CONSULTATIONS

Two sets of Public Consultation were organized for two out of three Rayons involved in the road enlargement, namely Gobustan and Shamakhi (please see Annex 1 and 2 for detailed minutes of the public consultation meetings). The Public Consultation in Absheron Rayon was not performed due as the only the village present in this section, namely Dzhangi at the km 45+000, had been already included in the previous consultation held for the first part of the Baku – Shamakhi (before than km 45+000).

The first set of Consultation has been held on the 17th January 2012 in Gobustan Rayon and on the18th January 2012 in Shamakhi Rayon.

The second set has been held on the 27th of February at 9 a.m. in Gobustan and at 3 p.m. in Shamakhi.

Totally the two round sets of consultation involved 123 people, out of which 84 in Gobustan Rayon and 39 in the Shamakhi one.

The following table summarizes the main concerns, questions and topics discussed during the Public consultations together with the response incorporation in the project Design and/or in the EIA:

Issues	Response
Absence of by passes in Gobustan and Sabir and measures for pedestrian safety	• Infrastructure design suggested to be incorporated in road design • Traffic regulation suggested • Speed limitation up to 40 Km/h • Horizontal al vertical signaling to be incorporated in the road design • Traffic light and or median divider in the intersection
pedestrian underpass and bridge	• No bridge overpass at all considered. Pedestrian underpass at the beginning on each side of the urban area traversed
animal under passes	• Animal underpasses in urban areas can be shared with pedestrian underpasses
gravel excavation, borrow pits and water issues management during the construction period	• Approval of an Excavation development plan together with a Management Excavation Plan
land and house compensation in case of expropriation	• At market price
avi-fauna and flora protection.	• Ecological Police and NGO's dedicated and local community team leader

10 ANNEXES

- ANNEX 0 - List of References
- ANNEX 1-2 – Public Consultations
- ANNEX 3 – Conference Calls
- ANNEX 4 – Statistical Survey
- ANNEX 5 – Maps
- ANNEX 6 – Monitoring Plan Matrix
- ANNEX 7 - Engineering – geological conditions of the landslide areas on 103-111 km of Baku-Shamakhi road
- ANNEX 8 – Environmental Management Plan
- ANNEX 9 - Flora, Fauna and Reforestation Plan – EMP1
- ANNEX 10 - Borrow Pit Management Plan – EMP2
- ANNEX 11 - Water Supply Management Plan – EMP3
- ANNEX 12 - Noise Suppression Plan – EMP4
- ANNEX 13 - Construction Traffic & Access Management Plan – EMP5
- ANNEX 14 - Material Management & Erosion Control Plan – EMP7
- ANNEX 15 - Emergency Response Plan – EMP8
- ANNEX 16 - Waste Management Plan – EMP9
- ANNEX 17 - Location and Campsite Management Plan – EMP10