Environmental Assessment Report

Initial Environmental Examination
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M6 Vanadzor-Alaverdi-Georgian Border Interstate Road Rehabilitation and Improvement Project
Volume 1 - ADB Section
Tumanian (Km 36) to border with Georgia (Km90)

This Initial Environmental Examination (IEE) is based on the data and information available in March 2015 and site visits in November 2015 and February 2016

Prepared by Ministry of Transport and Communication, Armenia for the Asian Development Bank

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Abbreviations

ADB	Asian Development Bank
AQP	Air Quality Plan
AR	Armenian Republic
CCP	Plan for Construction Camps
EIA	Environmental Impact Assessment
EIB	European Investment Bank
EIS	Environmental Impact Statement
EMP	environmental management plan
EO	Environmental Officer

ERP	Emergency Response Plan
HDDV	Heavy Duty Diesel Vehicles
HSP	Health and Safety Plan
IPIG	Investment Projects Information Group
PAH	Polycyclic aromatic hydrocarbons
SSEMP	Site Specific Environmental Management Plan
WMP	Waste Management Plan
END	

A. Introduction and Summary

i. Purpose of the Report

a. Identification of the Project and Project Proponent

1. The Government of Armenia (GOA) requested the Asian Development Bank (ADB) to co-finance the Proposed M6 Vanadzor–Alaverdi–Georgian Border Interstate Road Rehabilitation and Improvement Project (M6VAG) with the European Investment Bank (EIB). EIB has engaged an international consultant to complete a feasibility study, environment and social impact assessment, and detailed engineering design.

2. ADB intends to engage individual consultants to conduct due diligence in technical, social, and engineering.

3. The Project Proponent is the Ministry of Transport and Communication of the Republic of Armenia (MoTC) through its Transport Project Implementation Unit (TPIU).

b. Description of the Project

4. The Project road is located in the north of the country. The alignment is approximately 90 km long running from Vanadzor (the third-largest city in Armenia and capital of Lori Province) broadly North-east through Alaverdi and Ayrum (Tavush Province) to the Georgian Border close to Bagratashen (Tavush Province). Vanadzor is approximately 128 kilometres north of the capital Yerevan.

5. As a landlocked country and with two of its four land borders closed (Turkey to the west and Azerbaijan to the east) the road is vital to the economic development of the country. The current road is inadequate with tight bends and steep gradients making heavy vehicle passage difficult. In addition tunnels and bridges on the alignment need upgarading or replacement to meet accepted construction and safety standards

6. The carriageway of the existing interstate road is two lane, asphalt paved, with sand-gravel shoulders. The width of the carriageway is inadequate for an Interstate Road.

7. The pavement conditions are very poor, there are deformations, alligator cracking, and many transverse cracks, potholes and rutting. The horizontal alignment is very tortuous, with radii of curvature often under the minimum standard for an interstate road. In the stretch between Vanadzor and Alaverdi, from km 18 to km 19, there is a section with very sharp hairpin bends, hazardous for the transit of heavy vehicles, especially in the presence of snow and ice. In addition there are sharp vertical curves that reduce sight lines, generating road safety problems.

8. There are several sections along the road with slopes more than 9-10%, which create problems for heavy vehicles during the winter.

9. On the existing road there are 40 bridges and culverts (13 of which are 10m long or more) and 3 short tunnels, one will need replacement. Some major bridges are in quite good condition, some other bridges show evident and serious signs of deterioration (both geometric and structural issues).

10. The project will be spilt into two funding sections, the southern section From Vanazdor to Tumanian (Km 36) will be funded by the EIB. The northern section from Tumanian (Km 36) to the border with Georgia (Km90) will be funded by ADB.

c. Other background information

11. The Project has been the subject of detailed examination comprising a Feasibility Study, Environmental Impact Assessment and Detailed Engineering Design promoted by The Republic of Armenia, Ministry of Transport and Communication (MoTC) with the assistance of the European Investment Bank (EIB)[1].The final report prepared by Lotti Ingegneria SpA in collaboration with ArtsakhRoad is dated October 2015.

ii. Extent of the IEE studies

12. The EIB studies produced an Environmental and Social Impact Assessment Report which was included in the final EIB report (Oct 2015). However, the ADB has conducted its own environmental studies and prepared IEE documents for alignment. The ADB IEE has been prepared in two volumes:
    - Volume 1 – IEE for the ADB section of the alignment Tumanian (Km 36) to the border with Georgia (Km90); and
    - Volume 2 – IEE for eh EIB section of the alignment Vanadzor (Km0) to Tumanian (Km 36).

13. This IEE is Volume 1 - Tumanian (Km 36) to the border with Georgia (Km90). It reviews the existing environmental and engineering documentation prepared to date; reports on visits to the project site to inspect existing condition and status of the project road; provides a verification that the design complies with international standards and best practice, especially the environmental requirements, and proposes improvement measures where appropriate. As part of this report a Rapid Environmental Assessment (REA) Checklist has been prepared (Appendix 1) and the document also includes an Environmental Management Plan (EMP) in Section I – Page 53.

d. Summary of findings

14. Based on site inspections it has been concluded that project components do not encroach upon ecologically sensitive areas. They are located either within the boundaries / footprint of the existing road corridor. Decisions are still needed on the location of worksites to house the work force, construction equipment and materials but there are suitable sites available along the alignment where camps could be established that would not adversely impact on existing sensitive receivers.

15. Potential environmental impacts were identified in relation to design, location, construction and operation of the improved infrastructure and mitigation measures have been developed to reduce all negative impacts to acceptable levels.

16. Overall the proposed project is unlikely to cause any adverse environmental impacts. This is due to the following findings:

[1] EIB project reference: TA2012039 AM EST funded under the Eastern Partnership Technical Assistance Trust Fund (EPTATF)

- All of the alignment will be rehabilitated within the footprint of the existing road.
- There are no sites of cultural or heritage significance within the area of influence of the alignment.
- There are no ecologically sensitive sites or protected areas falling within the alignment or its zone of influence
- The road realignments will remove tight bends, overstep hills sections and improve sight lines making vehicle movements more safe and efficient.
- The road improvements will include incorporation or upgrading of safety equipment along the alignment
- Where appropriate slopes will be cut back to more stable angles and incorporate rockfall protection improving driver safety.
- Construction and operation of the project is likely to give rise to nil, negligible or at worst, minor temporary environmental impacts that can be easily mitigated to acceptable levels.

17. An Environmental Management Plan (EMP) has been prepared for the project. The EMPs are included as part of this IEE and include (i) mitigation measures for potential environmental impacts during implementation, (ii) an environmental monitoring program, and (iii) identification of the responsible entities for mitigation, monitoring, and reporting.

18. Mitigation will be assured by a program of environmental monitoring to be conducted during the construction stages. The environmental monitoring program will ensure that all mitigation measures proposed in the EMPs are implemented, and will determine whether the environment is protected as intended. Any requirements for remedial action will be reported to the ADB.

19. Project stakeholders were consulted during preparation of the IEE and invited to express any environmental and social concerns they had regarding the project. No significant environmental and social concerns were raised and all stakeholders consulted strongly support the project and are looking forward to the benefits of the improved road corridor. The IEE will be made available at public locations and will be disclosed to a wider audience via the ADB website. The consultation process will be continued during project implementation to ensure that stakeholders are fully engaged in the project and have the opportunity to participate in its development and implementation

20. Environmental and social benefits of the investment components and long-term project objectives far outweigh the minor and temporary inconveniences that will arise during project implementation. Provided the EMPs are properly implemented there will be no unacceptable impacts arising from the project..

B. Policy, Legal and Administrative Framework

i. Institutional Requirements

21. Environmental assessment of the project is undertaken with regard to complying with ADB and GOA policies, legislation, and requirements. This also includes complying with relevant international agreements:

a. Armenian Requirements

1. The 10th Article of the Constitution of the Republic of Armenia (adopted in 1995 and amended in 2005) stipulates that the State is responsible for environmental protection, reproduction and wise use of natural resources. Since 1991 more than 25 codes and laws as well as numerous by-laws and regulations have been adopted to protect the environment. The relevant national law on environmental protection and assessment is:

(i) Law on Environmental Impact Assessment and Expert Examination (July 22, 2014).

22. The list of key environmental laws regulating the field of nature protection of the RA is presented below:

- Law on Ensuring Sanitary-epidemiological Security of the RA Population (1992);
- Law on Atmospheric Air Protection (1994);
- Law on the Protection and Use of Fixed Cultural and Historic Monuments and Historic Environment (1998);
- Law on Environmental and Nature Use Charges (1998);
- Law on Flora (1999);
- Law on Fauna (2000);
- Land Code (1991, updated 2001);
- Law on Environmental Education (2001);
- Water Code (2002);
- Law on Wastes (2004)
- Law on Environmental Monitoring (2005);
- Law on Environmental Oversight (2005);
- Forest Code (2005);
- Law on Specially Protected Natural Areas (1991, updated 2006);
- Law on Rates of Environmental Charges (2006);
- Law on Environmental Impact Assessment (2014);
- Law on Transport (1998);
- Law on Automobile Roads (2006);
- On defining the procedure for implementation of public notice and consultations (November 19, 2014 N1325-N).
- Law on Hydro-meteorological Activity (2001)
- Code on Underground Resources (2002)
- Law on Seismic Defense (2002)
- Law on Water Users' Associations and Federations of the Water Users Associations (2002)

- Law on National Water Program (2006)
- Law on Oversight of Land Use and Protection (2008)

2. To reduce the differences between Armenian legislation and International environmental polices the new law on Environmental Impact Assessment and Expert Examination has been approved in July 2014. The new law defines the environmental assessment process. The law requires projects to be assessed according to a two stage process: (i) the preliminary stage, which including screening and categorization as category A, B, or C according activity type; and (ii) a main examination phase, where Category A and B projects are further examined. The law provides the list of proposed activities by categories subject to environmental impact expertise and also provides an outline for the EIA report which includes sections on analysis of the project impacts for both physical, biological and social environments, and cumulative impacts. The EIA Law specifies notification, documentation, public consultations, and appeal procedures and requirements.

3. Despite that the law introduces many improvements over the previous law there is still a number of gaps between the Law and ADB's Safeguard Policy Statement (2009) policy principles. In particular, requirements of environmental management planning and the contents of environmental management plans need to be strengthened.

4. Furthermore, in determining environmental standards for projects it supports, ADB follows the approach set out in the World Bank group's Environment, Health and Safety Guidelines (2007); although alternative emission levels and approaches to pollution prevention/abatement can be adopted if necessary to better reflect national legislation and local conditions.

5. Other pieces of pertinent environmental legislation are also considered during the assessment. These include, air protection, cultural and historical monuments, flora, fauna, water use, seismic defense, waste, hygiene, and workers' protection such as:

(i) Law on Specially Protected Areas (1991) outlines the procedures for establishing protected areas and their management. The Law defines four categories of protected areas in RA: (i) State Reserves; (ii) State Reservations; (iii) National Parks; and (iv) Nature Monuments.

(ii) Law on the Protection and Use of Fixed Cultural and Historic Monuments and Historic Environment (1998) provides the legal and policy basis for the protection and use of such monuments in Armenia and regulates the relations among protection and use activities. Article 15 of the Law describes procedures for - amongst other things – the discovery and state registration of monuments, the assessment of protection zones around them and the creation of historic-cultural reserves. Article 22 requires the approval of the authorized body (Department of Historic and Cultural Monuments Preservation) before land can be allocated for construction, agricultural and other types of activities in areas containing monuments. The Ministry of Culture has jurisdiction over archaeological, historical, and cultural sites. It is not, however, involved with the fate of modern monuments erected along the highway by private citizens in commemoration of accident victims. The relocation of those monuments will be coordinated by the respective provincial authority (*marzpeds*).

(iii) Law on Flora (1999) and Law on Fauna (2000) outline Armenia's policies for the conservation, protection, use, regeneration, and management of natural populations of plants and animals, and for regulating the impact of human activities on biodiversity. These laws aim for the sustainable protection and use of flora/fauna and the conservation of biodiversity. The laws provide for assessing and monitoring species, especially rare and threatened species.

(iv) Law on Atmospheric Air Protection (1994 and last amended in 2007) regulates the emission licenses and provides maximum allowed loads/concentrations for atmospheric air pollution, etc. There is secondary legislation that establishes sanitary norms for noise in workplaces, residential and public buildings, residential development areas, and construction sites.

(v) Land Code (2001) defines the main directives for use of the lands allocated for energy production, water economy (water supply, water discharge, pumping stations, reservoirs, etc.), and other purposes. The Code defines the lands under the specially protected areas as well as forested, watered, and reserved lands. It also establishes the measures aimed at protection of the lands as well as the rights of state bodies, local authorities, and citizens towards the land.

(vi) Code on Underground Resources (2002) contains the main directives for use and protection of mineral resources and underground water, including the sanitary protection zones for the underground water resources.

(vii) Water Code (2002) provides the legal basis for the protection of the country's water resources, the satisfaction of water needs of citizens and economic sectors through effective management of water resources and safeguarding the protection of water resources for future generations. The following regulations and procedures of the Water Code (2002) are relevant: (a) permitting procedures, (b) environmental flows, (c) drainage water, (d) water alternative accounting, (e) access to information on trans-boundary water, (g) reservation of underground water sources, (h) registration of documents in state water cadaster, and (i) public awareness and publicity of the documents developed by WRMA and other normative documents which provide guidelines directly linked with water and environmental issues.

(viii) Law on Wastes (2004) provides the legal and economic basis for collection, transportation, disposal, treatment, and re-use as well as prevention of negative impacts of waste on natural resources, human life, and health. The law defines the roles and responsibilities of the state authorized bodies in the waste sector.

(ix) Law on Environmental Oversight (2005) regulates the issues of organization and enforcement of oversight over the implementation of environmental legislation of Armenia and defines the legal and economic bases underlying the specifics of oversight over the implementation of environmental legislation, the relevant procedures, conditions and relations as well as environmental oversight in Armenia. The existing legal framework governing the use of natural resources and environmental protection includes a large variety of legal documents. Government resolutions are the main legal implementing instruments for environmental laws. The environmental field is also regulated by presidential orders, Prime-Minister's resolutions, and ministerial decrees.

b. International Agreements

23. In addition to the above presented list and summaries of laws, numerous strategies, concept frameworks, and national programs related to the nature protection have been developed as well as a number of international agreements and conventions have been signed and ratified by the Republic of Armenia.

Table 1 Multilateral international environment agreements signed/or ratified by Armenia.

Title, place and date adopted	Ratified by National Assembly	In force for RA
Global Conventions		
Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar, 1971) - aka Ramsar Convention	Acceded as assignee by the request of MFA RA 1993	1993
UN Convention on Biological Diversity (Rio de Janeiro, 1992)	31 Mar 1993	14 May 1993
Cartagena Protocol on Bio-safety (Montreal, 2001)	16 Mar 2004	29 Jul 2004
UN Framework Convention on Climate Change (New York, 1992)	29 Mar 1993	21 Mar 1994
Kyoto Protocol (Kyoto, 1997)	27 Dec 2002	16 Feb 2005
Convention Concerning the Protection of the World Cultural and Natural Heritage (Paris, 1972)	Acceded as assignee by the request of MFA RA in 1993	1993
UN Convention to Combat Desertification (Paris, 1994)	23 Jun 1997	30 Sep 1997
UN Convention on the Control of Trans-boundary Movements of Hazardous Wastes and Their Disposal (Basel, 1989)	26 Mar 1999	01 Oct 1999
Convention for the Protection of the Ozone Layer (Vienna, 1985)	28 Apr 1999	01 Oct 1999
Montreal Protocol on Substances that Deplete the Ozone Layer (Montreal, 1987	28 Apr 1999	01 Oct 1999
London Amendments to the Montreal Protocol	22 Oct 2003	26 Nov 2003
Copenhagen Amendments to the Montreal Protocol	22 Oct 2003	26 Nov 2003
Montreal amendment to the Montreal Protocol	29 Sep 2008	18 Mar 2009
Beijing amendment to the Montreal Protocol	29 Sep 2008	
Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (Rotterdam, 1998)	22 Oct 2003	26 Nov 2003
Stockholm Convention on Persistent Organic Pollutants (Stockholm, 2001)	22 Oct 2003	17 May 2004
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (Washington, 1979)	10 Apr 2008	21 Jan 2009
Convention on the Conservation of Migratory Species of Wild Animals (Bonn, 1979)	27 Oct 2010	01 Mar 2011
Regional (European) conventions		
UNECE Convention on Long-range Trans-boundary Air Pollution (Geneva, 1979)	14 May 1996	21 Feb 1997
Protocol on Long-term Financing of the Cooperative Program for Monitoring and Evaluation of the Long-Range Transmission of Air Pollutants in Europe (EMEP)	In the process of ratification	
UNECE Convention on Environmental Impact Assessment in a Trans-boundary Context (Espoo, 1991)	14 May 1996	10 Sep 1997

Protocol on Strategic Environmental Assessment (Kiev, 2003)	25 Oct 2010	24 Apr 2011
The Protocol on Pollutant Release and Transfer Registers (Kiev, 2003)		
UNECE Convention on Trans-boundary Effects of Industrial Accidents (Helsinki, 1992)	14 May 1996	21 Feb 1997
UNECE Convention on access to information, public participation in decision making and access to justice in environmental matters (Aarhus, 1998)	14 May 2001	01 Aug 2001
Protocol on Water and Health (London, 1999)	In the process of ratification	
Convention on the Prohibition of Military or Any Hostile Use of Environmental Modification Techniques (Geneva, 1976)	04 Dec 2001	15 May 2002
UNECE Convention for the Protection and Use of Trans-boundary Watercourses and International Lakes (Helsinki, 1992)	22 Oct 2003	
European Landscape Convention (Florence, 2000)	23 Mar 2004	01 Jul 2004
Convention on the Means of Prohibiting and Preventing the Illicit Import, Export and Transfer of Ownership of Cultural Property	22 Jun 1993	
Convention Concerning the Protection of World Culture and Natural Heritage	22 Jun 1993	
European cultural convention	22 Jun 1993	
Convention for Protection of Non-material Cultural Heritage	20 Mar 2006	
Bern Convention - Council of Europe Convention on the Conservation of European Wildlife and Natural Habitats (Bern, 1979)	26 Feb 2008	01 Aug 2008

c. Permitting Requirements

24. Environmental permits, agreements, conclusions necessary for accomplishing the works envisaged by Rehabilitation and Improvement of M6 Vanadzor-Alaverdi-Georgian Border Interstate Road, including data on issuing authorities and tentative timing of obtaining the permit are summarized in the table below:

Table 2 Environmental permits, agreements, etc.

Name of permit, agreement, etc.	**Issuing authority**	**Obtaining stage**
Environmental Expertise conclusion	Environmental Expertise SNCO of the Ministry of nature Protection	During design stage
Technical Expertise conclusion	Licensed organization	During design stage
Construction license	Ministry of Urban Development	After design stage, prior to bidding
State Traffic Police Permit Traffic Police of RA	Permit obtained during the design stage. Traffic Management Plan to be approved prior to commencement of civil works in each section during implementation stage. Construction permit Head of the appropriate community	Prior to construction

Lease agreement or ownership documents for construction site	Property owner	Before establishment of the construction site
Mining license[2]	Ministry of Economic Development	During construction stage
Purchase documents for purchased construction materials (such as crushed stone, gravel, cement, sand, etc.)	Authorized seller	During construction stage for purchase of the construction materials
Conclusion of Technical Security Expertise Department	Ministry of territorial Administration and Emergency Situations	During construction stage (required for some types of heavy machinery, technological processes that require use of a compressor or compressor stations, fuel storages exceeding certain capacity, etc.)
Maximum permissible discharge permit	Ministry of Nature Protection	During construction stage
Agreement for disposal of construction waste	Head of the appropriate community	During construction stage, before disposal of the waste off-site
Agreement for disposal of dangerous and hazardous materials and waste	Ministry of Nature Protection	During construction stage, before disposal of the dangerous and hazardous materials and waste off-site

25. Though all of the permits identified in the table are relevant for the Project implementation, some of them might not be necessary depending on the nature of works and their organization (e.g. contractor is not required to hold a mining license when crushed stone is purchased. However the company producing the crushed stone should possess a valid mining license).

ii. Institutional Setting

26. This section briefly presents the roles of entities that may have involvement in the Project, primarily but not exclusively from an environment perspective.

d. Ministry of Nature Protection

18. The Ministry of Nature Protection (MNP) is responsible for the protection, sustainable use, and regeneration of natural resources as well as the improvement of the environment in the Republic of Armenia. In those areas, the MNP authority includes overseeing national policy development, developing environmental standards and guidelines, and enforcement. The MNP implements those functions through the following structural departments:

- Normative-methodological Department (including Division of Legislation and Division of Standards and Technical Regulations);
- Department of International Cooperation;
- Department of Environmental Protection (including Division of Biodiversity and Water Resources Protection and Division of Land and Atmosphere Protection);
- Department of Hazardous Substances and Waste Management;
- Department of Nature Protection and Environmental Economics;
- Department of Underground Resources Protection;
- Department of Meteorology and Monitoring of Atmosphere Pollution.

[2] During construction stage for purchase of the construction materials

19. The key departments within the MNP that have administrative authority over EIA and the project approval process are:

(i) The "Environmental Impact Expertise Center" (EIEC), the State Non-commercial Organization (SNCO) is responsible for reviewing and issuance of assessment conclusion reports required for implementation of a project and adding conditions when necessary to protect the environment; and

(ii) The State Environmental Inspectorate (SEI) is responsible for inspecting projects to ensure compliance with conditions imposed by the EIEC and with the Project EMP.

20. The EIA process and the SEI's power to inspect are the principal tools used by the MNP to achieve compliance with environmental protection principles. To satisfy relevant regulations and to gain a positive assessment conclusion from the MNP, this EIA report should be prepared in accordance with the Law on Environmental Impact Assessment and Expert Examination (July 22, 2014) and the legislative provisions relevant to environmental protection should be considered accordingly.

21. The MNP is also the Government authorized body in the area of waste management of the RA. Article 8 of the Law on Waste (24.11.2004) sets authorities of the environmental sector (Ministry of Nature Protection of RA) as the state authorized body mandated with the tasks and responsibilities in the area of waste management.

e. Ministry of Energy and Natural Resources

22. The Ministry of Energy and Natural Resources is a republican body of executive authority, which elaborates and implements the policies of the Republic of Armenia Government in the energy sector. The ministry is also responsible for the protection, sustainable use, and regeneration of natural resources, and implements its functions through the following separate divisions and agencies:

- Agency of Mineral Resources;
- Subsoil Concession Agency.

f. Ministry of Territorial Administration and Emergency Situations

23. Regional administration bodies are responsible for administration of public roads of local significance falling under the regional jurisdiction. Bodies of local self-government (communities) are responsible for administration of public roads of local significance registered as ownership of communities. The Ministry of Territorial Administration and Emergency Situations also elaborates and implements the policies of the Republic of Armenia Government in the area if civil defense and protection of population in emergency situations. Armenian State Hydro-meteorological and Monitoring Service SNCO is among the structural entities acting within the Ministry of Territorial Administration and Emergency Situations.

g. Ministry of Transport and Communication (MoTC)

24. The Republic of Armenia Ministry of Transport and Communication is a republican body of executive authority, which elaborates and implements the policies of the Republic of Armenia Government (GoA) in the transport, communication, and information technologies sectors. The Department on Road Construction is the main structural

subdivision of the Ministry involved in road sector, and mainly in developing state policy on improvement and perspective development of road network in the country.

h. Transport Project Implementation Unit SI of the MoTC

25. This is an organization established by the GoA to implement investment and development projects in transport sphere developed by the MoTC and regional administrative bodies and approved by the GoA at the expenses of the State Budget and funding provided to the Republic of Armenia by foreign states and international financing organizations.

i. Armenian Roads Directorate SNCO of the MoTC

26. This is an organization established by the GoA involved in development of projects aimed at improvement and expansion of road network, implementation of various studies and analysis with respect to development, operation and maintenance of roads.

j. Ministry of Health

27. Within the structure of the Ministry of Health of RA the State Hygienic and Anti-epidemiological Survey is responsible for coordination of all issues related to health (including those on noise and vibration) and for supervision over implementation of sanitary norms, hygienic and anti-epidemiological measures implementation by organizations and citizens.

k. Ministry of Culture

28. The Ministry of Culture is a republican body of executive authority, which elaborates and implements the policies in the culture sector. The purpose of the ministry is to maintain and replenish the cultural heritage, promotion and development of contemporary art. The Ministry also includes the following separate divisions: • Agency for Protection of Cultural Heritage; • Historical and Cultural Heritage Protection Agency.

C. Description of the Project

i. Type of Project

25. The project type is a “Loan”.

ii. Category of Project;

26. Safeguard categories. Environment – to be determined, Involuntary Resettlement – B, Indigenous Peoples – C.

iii. Need for Project;

27. The M6 road (Vanadzor – Alaverdi – Georgian border) is a major transport corridor for Armenian import and exports, connecting the country with the Georgian ports on the Black sea and the different destinations within the Commonwealth of Independent States (CIS) and Europe. Being a landlocked country, Armenia depends heavily on transport and crossborder accesses, but today only two international borders are open: Three (including the M6) with Georgia to the North and one to Iran in the South. The Eastern border with Azerbaijan was closed in 1991, and the western border with Turkey in 1993. This restriction together with Armenia’s severe continental climate (very low temperatures and heavy snowfall in winter) result in high transport costs, particularly for traded goods, and expensive infrastructure development and maintenance. The project aims at decrease road transport cost along the M6 and ease the import/export of Armenian goods through Georgia and its Black sea ports (Poti and Batumi). The project road is also part of the Asian Highway A81 Georgia Border (Bagratashen) -Yerevan-Eraskh (Turkish border) that in future could enhance possible transit traffic through Armenia.

28. The current alignment is sub-standard in terms of vertical and horizontal alignment (tight curves, steep gradients and poor sight lines), deficient in safety features (edge barriers and central reserves) and overstep slopes are susceptible to rockfalls. Some bridges and tunnel are substandard and need replacement.

iv. Location

29. The Project is located in the north of the Republic of Armenia. The project commences at the city of Vanadzor (Վանաձոր), the third-largest city in Armenia and the capital of the Lori Province. Vanazdor is approximately 128 kilometres north of the capital Yerevan (Երևան). From Vanadzor the Alignment heads in a broadly north–east direction for about 65 kilometers passing through Alaverdi (Ալավերդի) a regional and nationally important commercial and industrial centre to the small town of Ayrum (Այրում) in Tavush Province where it turns North-west for the last 25Km to the Georgian border just beyond the town of Bagratashen (Բագրատաշեն), Tavush Province.

30. The alignment runs parallel to an electrified railway corridor running from Vanadzor to the Georgian Border and alongside the River Pambak (Vanadzor to Tumanyan (Թումանյան) that joins the River Debed at Tumanyan and continues to the Georgian Border.

31. The alignment can be divided into four distinct section:

- Km 0 to 6.5 - Urban section through Vanadzor
- Km 6.5 to 50.8Km – Rural section (low population density – isolated development and small villages) between Vanadzor & Alaverdi – **Critical section for reconstruction.** Not

that section 6.5 to 36Km is the EIB funded project and 36 to 50.8Km is the ADB funded project.

- Km50.8 to 54Km – Urban section through Alverdi
- Km 54 to Km90 – Rural section (low population density – isolated development and small villages) from Alverdi to the Georgian Border. Lower reaches of valley system and plain.

Table 3 Key features of the M6 Alignment

Sector		Area	Key features	Main construction
0 / 6.5Km	EIB Section	Urban section through Vanadzor - along the Baghramyan Avenue.	Urban road on flat ground. The road is in fair condition.	Milling, relaying asphalt & upgrading street furniture
6.5 / 36Km		Rural section - Vanadzor to Tumanian	Winding through canyon, alignment tortuous, horizontally / vertically. km 18.4 critical, steep and curves. Tunnels at 25.0, 30.8 and 31.5	Rockfall areas shotcrete and pinning. Tunnel upgrading at 25.0, and 31.5 and rebuild (drilling and blast) at 30.8. Replacement of 2 damaged bridges
36 / 50.8Km	ADB Section	Rural section - Tumanian to Alaverdi	Winding through canyon	Rockfall areas shotcrete and pinning. Bridges replaced or major repair at Km39, 47.
50.8 / 54Km		Urban section through Alverdi	Urban road on flat ground. The road is in fair condition.	Milling, relaying asphalt & upgrading street furniture
54 to 90Km		Rural - Alverdi to Border - Lower valley and plain	7 rockfall areas before Karpok. nine bridges. At Km 82.7, near Ayrum, there was a severe landslide in 2011.	Milling, rockslope rehabilitation, relaying asphalt & upgrading street furniture. Bridge works at 62, 72, and 76.

Figure 1 Alignment of M6 (Vanadzor - Alaverdi - Ayrum - Georgian Border)

v. Size or Magnitude of Operation;

32. The Final Engineering Report for the Project[3] notes a focus on reconstruction work in the section between the urban area of Vanadzor (6.7Km) and Alaverdi (50.7Km). This section includes[4]:

- Steeper sections (>8%);
- Hairpin bends;
- Tunnels (3 No. 2 need upgrading and 1 needing reconstruction);
- Bridges needing reconstruction (4 of 6);
- Rockfall areas needing attention (21 of 28);
- Narrow road widths (5.00m rather than the 9.0m standard);
- Tight road radii; and
- Lack of safety devices.

33. The Final Engineering Report suggests that the project is split into two Lots (for EIB and ADB funding respectively:

- Lot 1 (EIB) – 6.7Km of urban Vanadzor and 32 Km from Vanadzor to Tumanyan;
- Lot 2 (ADB) – 3.4Km of urban Alaverdi and 48.3Km from Tumanyan to the Georgian border.

34. The rational is that this would divide the project into two Lots requiring similar construction effort (36 months) and similar construction cost. The following table, extracted from the engineering report sets out construction quantities.

Table 4 Construction material quantities

		Lot 1 (EIB)	Lot 2 (ADB)	Total
	Start Km	0 +000	38 +450	-
	End Km	38 + 450	90 + 191	-
	Total Km	38 + 450	51 + 741	90 + 191
Earthworks	General (m^3)	492,030	571,910	1,063,940
	Rock (m^3)	148,080	147,680	295,760
	Fill (m^3)	30,260	15,810	46,070
Pavement (Asphalt, base and sub-base)	Option 1 - Htot 62cm	10,641	0	10,641
	Option 2 – Htot 49cm	227,505	244,096	471,601
	Option 3 – Htot 41cm	0	18,733	18,733
	Option 4 – Cold recycling Htot 31cm	0	23,147	23,147
	Option 5 – Milling & replacing Asphalt	95,927	114,462	210,389
Concrete	(m^3)	24,977	28,283	53,260
Steel	(tons)	160	40	200
Drainage	Box (No)	3	0	3
	Pipe (No)	30	50	80
Bridges	New (No)	3	0	3
	Rehab (No)	30	50	80
Tunnels	(m)	568	0	568
Walls	(m^2)	18,300	7,276	25,576
	Simple Drapery HR300 (m^2)	10,695	9,217	19,912

[3] Section 16, Phase III Report October 2015 (Report ENG rC2)
[4] Section 3.2 Engineering Report (Oct 15)

Rockfall Protection	Simple Drapery HR50 (m²)	21,497	2,867	24,364
	Large Rock secured drapery (m²)	6,747	0	6,747
	Secured Drapery inc 5m nails (m²)	0	10,636	10,636
Road Safety	Guardrails (m)	14,164	19,174	33,338
	Jersey Wall / Barrier (concrete) (m)	1,740	0	1,740
Cost	(USD)	39.9M	40.3M	

Source: final Engineering Report (Oct 2015 – Section 15 (No table number)

vi. Proposed Schedule for Implementation

35. The final Engineering Report proposes that the project would be divided into two Lots requiring similar construction effort (36 months).

vii. Description of the project

36. The carriageway of the existing road is two lane, asphalt paved, with hard shoulder. The width of the paved asphalt strip is narrow and in some sections very narrow, varying from 5.00 to about 6.00m, with shoulders of about 0.50m.

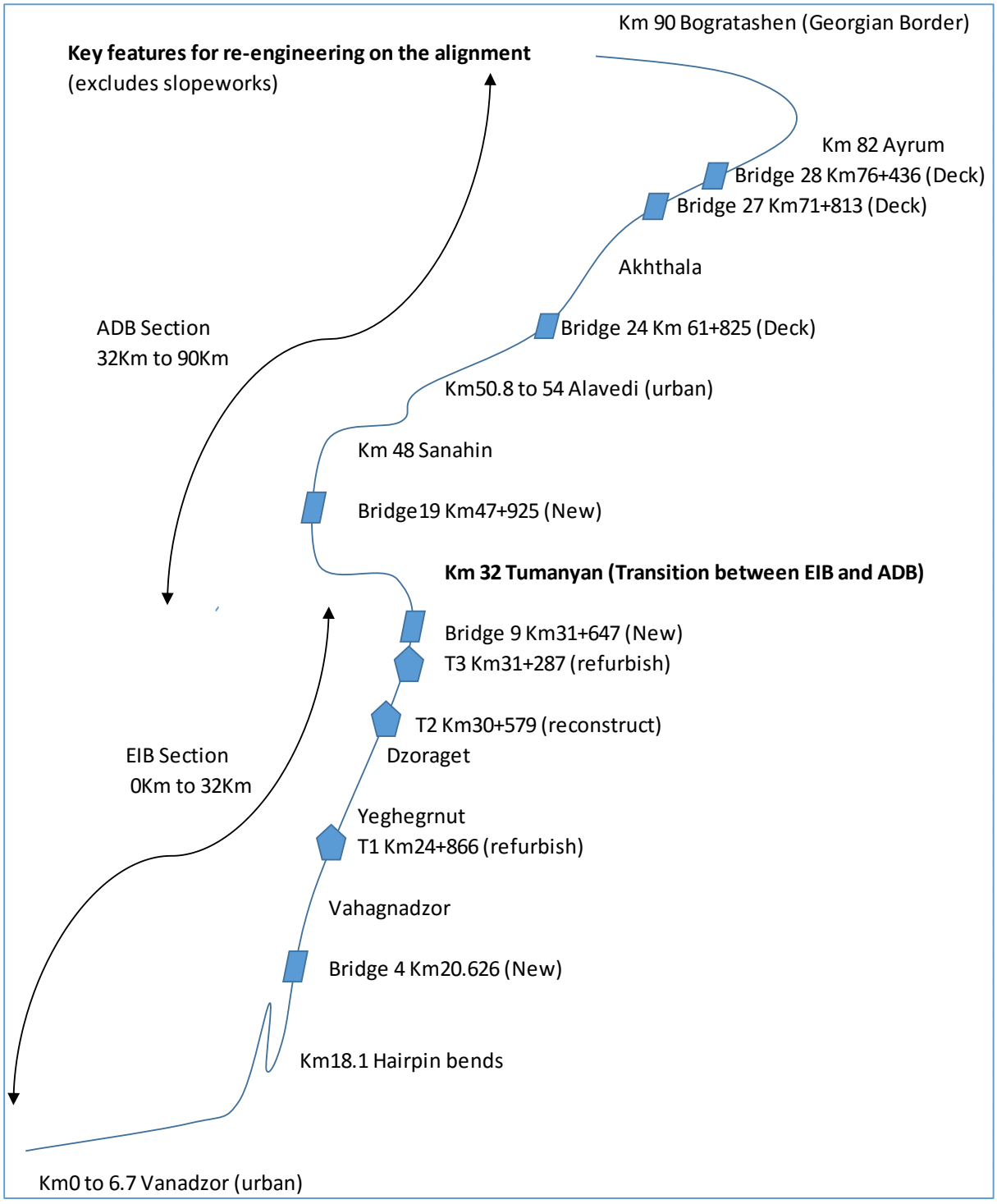
37. The design consultant has been directed to find a design that identifies the most needed interventions to improve road safety within an available budget of $ 100 million. To reach the target the Consultant has adopted two basic criteria for the improvement of the M6 interstate road, which are to: (i) adapt the standards as match as possible to those provided by the Armenian Norms; and (ii) to improve the safety for road users (reducing the problems of slopes instability), adopting the following actions:

- to take action only in the most problematic sections (from Vanadzor to Alaverdi), which represents the most critical part of the existing infrastructures, and consequently the most challenging part for the rehabilitation;
- to adopt the typical cross section of Category III.b, (two, 3.0m lanes with a 0.3m Shoulder stip – Total width 10.8m)[5] but with reduced shoulders;
- to limit the new pavement only where strictly necessary;
- to reduce as much as possible all other interventions (Rockall protections, Walls and River protection, avoid provision of Cut and Cover Tunnels), taking action only where strictly necessary;
- to reconstruct only the main damaged bridges;

38. They concluded that investment cost is the lowest while the expected benefits are the highest. With this solution is achieved a good compromise between investment costs and the technical features proposed.

[5] EIB - Feasibility Study, Environmental Impact Assessment (EIA) and Detailed Engineering Design, Final Engineering Report (Oct 2015) Table 3

Figure 2 Schematic of Key features for re-engineering on the alignment



D. Description of the Environment (Baseline Data)

i. Physical Resources

a. Atmospheric conditions

39. The mountains, elevation, geographic location are important for the climatic conditions of Pambak-Debed mountain-valley region. It is considered to be the northern part of subtropical zone with a diverse climate due to the large difference in altitude (380-3150m). However conditions are generally not severe with comparatively mild winters are and summers that are not too hot. Wind direction is distributed unevenly due to seasons and altitude. The maximum wind speeds in a high mountain zone are observed in winter and the minimum in summer. The average annual wind speed in mountain passes can reach up to 7.5-7.8 m/sec, especially from December up to the end of February. In extreme conditions the wind strength can reach up to 30 m/sec. Evaporation and redistribution of snow layers depend on wind speed.

40. The valley of Pambak River itself has mild summer when the average temperature ranges between 18,0-18,5˚. The average winter temperature ranges between -5 to -5,5˚. The absolute minimum temperature in Vanadzor reaches up to -30- -32 ˚ (in Pambak River basin), in Stepanavan town it is -34˚, and in Tashir -36˚ (in the middle and upper reaches of Dzoraget basin). In Pambak River basin the absolute air temperature reaches 36 to 37˚ during summer months, and in Dzoraget basin it is 30˚

Table 5 Average monthly and average annual air temperature (°C)

	Jan	Feb	March	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	**Ave**
Bagratashen	0.3	1.7	5.6	11.6	16.5	20.1	23.1	22.6	18.3	12.4	6.7	2.2	**11.8**
Vanadzor	-3.1	-2.0	1.7	7.6	12.1	15.1	18.0	17.9	14.4	9.0	3.8	-0.8	**7.8**

Table 6 Absolute minimum air temperature (°C)

	Jan	Feb	March	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	**Ave**
Bagratashen	-21	-17	-12	-7	1	3	9	9	1	-4	-7	-14	**-21**
Vanadzor	-29	-30	-26	-12	-4	0	3	1	-3	-12	-22	-23	**-30**

Table 7 Depth of frozen soil layer (cm)

	Average					Maximum					During Winter		
	Nov	Dec	Jan	Feb	March	Nov	Dec	Jan	Feb	March	Average	Max	Min
Bagratashen	-	3	8	4	-	-	3	15	5	-	6	15	3
Vanadzor	9	25	42	38	0	19	55	74	72	12	45	74	16

41. The annual precipitation in the upper section of Pambak River basin is 638 mm (in Nalband) and in Vanadzor it reaches up to 586mm; in some areas the precipitation reaches up to 700mm. Most of the precipitations occurs in the spring and summer months.

42. Precipitation decreases in winter months and they are mostly expressed in form of snow that forms surface cover, which remains for 2.5-3 months. The snow layer capacity can reach up to 180 cm depending on the altitude of the area and the nature of relief (upland and lowland).

43. The climatic conditions are slightly different in Debed River valley where the project is located. It is distinguished by high temperature in summer. In January the average air

temperature in Shnogh[6] is -0.8˚ and in July the average is 22.3˚. The absolute minimum temperature in Shnogh is more than -22˚. The days without frost are about 230. The annual precipitation in Debed valley is approximately 500 mm, but towards Kura valley it decreases and reaches up to 300 mm (Bagratashen) and, on the contrary, it increases in the direction opposite to the river flow, reaching up to 600 mm. The warmest place of Pambak-Debed is Bagratashen lowland plain which is surrounded by forested mountains with its own climatic conditions. The absolute minimum temperature is -0.5˚ here and the average temperature of the hottest month is 23.5˚, and the maximum temperature is 42˚. Inversion temperature phenomena are observed here in winter months, as a result of which the air temperature can reach up to -21˚.

Table 8 Monthly and annual amount of precipitation (mm)

	Jan	Feb	March	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	**Ave**
Bagratashen	22	26	41	52	76	76	46	34	35	38	34	20	**500**
Vanadzor	17	25	36	62	95	92	56	41	34	45	35	19	**557**

b. Air Quality

44. . Information has been obtained from the Government website on air quality in Vanadzor and Alaverdi.

45. Monitoring of sulfur dioxide, nitrogen dioxide and dust has been carried out in Vanadzor city. There are three active samplig stations and 24 passive sampling stations functioning in Vanadzor city during 2015. 3130 air samples were taken through active (24-hour long) sampling and 2490 through passive sampling.

Air Quality at Vanadzor

Table 9 Air quality data for Vanadzor (2015)

Substance (number of stations)	Maximal observed concentration mg/m^3 (number of the station)		Quantity exceeding MPC		Average annual concentration, mg/m3	Average daily MPC mg/m3
			>1 MPC	>5 MPC		
sulfur dioxide (3)	0.079	(st. N3)	14	0	0.011	0.05
Nitrogen dioxide (3)	0.042	(st. N2)	5	0	0.013	0.04
Dust (3)	0.384	(st. N3)	7	0	0.055	0.15

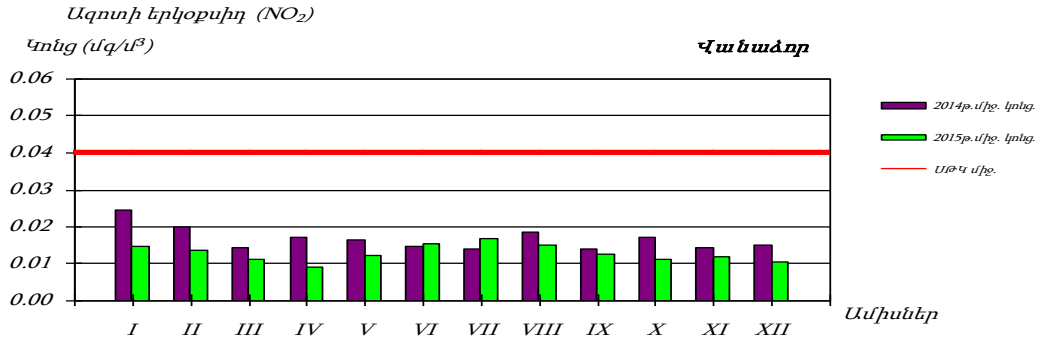
46. The concentration of sulfur dioxide eceeds annual average maximum permissible concentration (MPC) by 1.5 points.

47. Nitrogen dioxide and dust do not exceed corresponding maximum permissible concentrations.

48. The following figure shows the monthly variation in NO_2 during 2014 and 2015

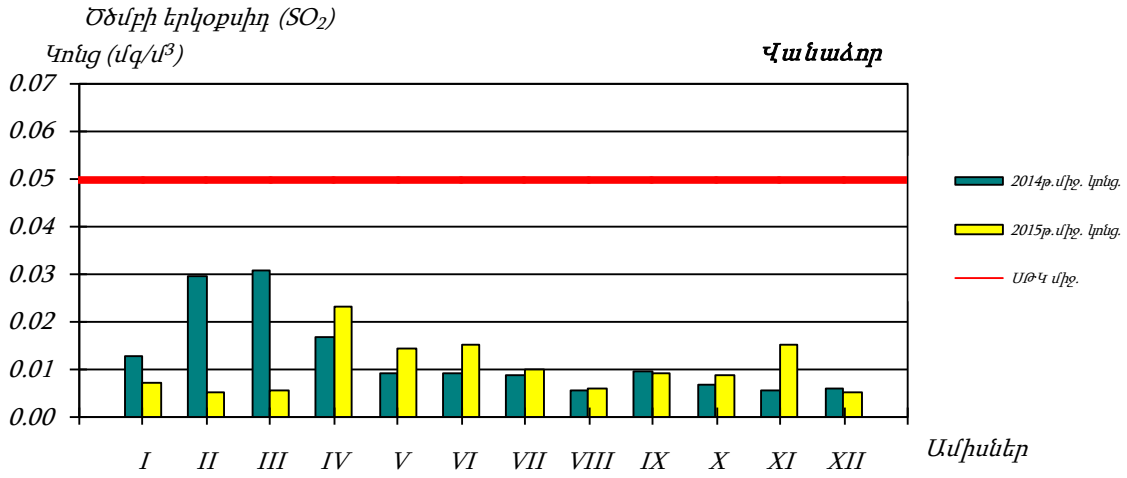
[6] Shnogh is located in the east of Lori Province just south of the alignment.

Figure 3 Nitrogen Dioxide (NO_2) concentration by month for Vanadzor (2014 and 2015)



Note. red line is Maximum Permitted Concentration (MPC)

Figure 4 Sulfur dioxide (SO_2) by month for Vanadzor (2014 and 2015)



Air Quality at Alaverdi

49. Monitoring of the sulfur dioxide, nitrogen dioxide carbon monoxide and dust was implemented in Alaverdi city. Three active sampling stations and 38 passive sampling stations has been functioning in Vanadzor city in 2015. 2552 air samples were taken through active (24-hour long) sampling, 3879 samples of dust and 110409 observations were implemented on the automated observations station.
50. Maximal annual carbon monoxide concentration was observed on April 7 at 0:15 and was equal to 5.17 mg/m3, nitrogen monoxide- on march 2 at 16:00 and was equal to 0.099 mg/m3, nitrogen dioxide-on May 30 at 20:00 and was equal to 0.152 mg/m3.

51. Average annual concentration of the sulfur dioxide exceeds MPC by 1.9. Average annual concentrations of the other observed indicators did not exceed corresponding MPCs.

Figure 5 Air quality data for Alaverdi (2015

Substance (number of stations)		Quantity exceeding MPC		Average daily MPC mg/m3

	Maximal observed concentration mg/m3 (number of the station)		>1 MPC	>5 MPC	Average annual concentration, mg/m3	
sulfur dioxide (3)	0.122	(st. N3)	58	1	0.019	0.05
Nitrogen dioxide (3)	0.178	(st. N1)	8	0	0.010	0.04
Dust (2)	0.291	(st. N2)	69	0	0.069	0.15

52. **Air Quality Summary**. The available long term monitoring data is limited to the urban areas of Vanazdor and Alaverdi. The results indicate Sulphur dioxide concentrations are high. This could be due to emissions from vehicles but is more likely to be from industrial emissions. In addition Alaveri has elevated levels of dust, this is not surprising given the level of industrial activity in Alaverdi. There is no information on the air quality on the non-urban sections of the alignment. Most aspects of road construction are transitory in nature. They occur and quickly move on in a rolling chain of activity. It is therefore proposed that monitoring is focused on pre, during and post construction phases at key locations in urban areas (Vanadzor and Alavedi) and on the alignment (upto four locations). There were no air quality sensitive locations[7] identified adjacent to the alignment during the desk studies and site visits.

c. Topography and soils

53. Pambak-Debed river valley being considered a typical mountainous area has vertical zonality where the windward slopes type prevail with mild climate, and where mostly folded and folded- block mountains slopes forest landscapes and surface runoff occur. The real mountain steppe with soil-vegetable cover spreads over in the west of Pambak-Debed region in the uplands of the valley. Brown, grey and brown forest soils (with humus content of 4-6%) are widespread in the region.

54.

55. Clay fractions occur near the Pambak River flood plain area, and emaciated soils occur on the steep slopes. Diluvial formations with sandy clay and coarse gravel composition are more widespread. Mountain-meadow soils are widespread in the high mountain slopes (in Tandzut River upper basin).

56. Dense vegetation, abundance of species composition, turfness of soil, etc. are typical of the mountain steppe. The widespread plant species are fescue, bluegrass, couch grass, etc. Daisy, bluebell, etc. are typical for meadow steppe.

57. Mountain steppe covered by typical black soils (with the capacity of 75-90 cm, with up to 15% humus content), is prevailing in the basin of one of the important rivers of Pambak-Debed region - Dzoraget River, where matgrass grows. Here the typical plant species are melur, and other different types of grasses. The southern part of Dzoraget River basin is covered with oak, beech, hornbeam and pine trees.

[7] Air quality sensitive locations include schools, hospitals, etc.

58. Water nourishment of rivers and tributaries in the alpine zone takes place through melted snow, with low evaporation. The main part of Pambak-Debed Rivers and tributaries are formed in this zone, which flow slowly near the river head, often with twists, and in the middle and lower streams their speed increases according to increase in slopes grade depending on the processes of depth and side erosion.

d. Surface water

59. Vanadzor-Bagratashen Road starts from the western part of Vanadzor town, passing through Pambak River left bank up to Dzoraget, then it crosses the biggest tributary of Debed River- Dzoraget, next passing to the right bank of Debed River, near Tumanyan village - to the left bank, after that near Alaverdi town it passes to the right bank and up to its end - Bagratashen village, it stays on the right bank. In the meantime the road crosses many big and small ravines and ≈18 runoff tributaries (with the areas from 2.5 km2- to 66 km2), 6 average size tributaries (24 km2-114 km2), and the other 6 rivers are among the big ones (Shnogh, Marts, Dzoraget, Pambak and Debed Rivers). The data regarding the rivers crossing the road are given in the runoff reference. It should be only mentioned that Debed River has a length of 152km and 3790km2 catchment area in the territory of the Republic of Armenia. The river is called by that name after mixing with the two components - Dzoraget (67km) and Pambak (72 km).

60. The beginning of Debed is considered to be Pambak river head, in the eastern part of Jajur mountain pass saddle, at a height of about 2091m. The river continuously flows towards the east, starting from Meghrout village towards the north, from Alaverdi town towards north-east. From the point of mixing with Chichkan tributary up to Spitak town it flows through a narrow gorge, after that it gradually becomes wider. After the Vanadzor hollow it enters the narrow forested gorge of Gayladzor, flows through rocky channel, at a quite high speed, and the river decline is 23 m/km. After Vahagni village Pambak gorge comes with a depth of 250-350m, which continues up to Alaverdi town, keeping its width of 20-40m. Starting from Ayrum station the river flows through a wide terraced valley.

61. There are 1356 rivers and tributaries in Debed River system, out of which 55 have more than 10 km length. The factor of river network average depth is 092 km/km2. The water regime of Pambak-Debed river tributaries is unstable, as the river nourishment is also unstable: seasonal, highly depending on atmospheric precipitations (55%), melted snow, underground waters (45%). Pambak water level greatly increases starting from April, decreasing slowly till August. Under the conditions of low quantity of rainfall the underground water remains the main nourishment source. There can be short-term inundations in autumn and partial ice-covering in winter.

62. The role of rain nourishment increases in the runoff formation of Pambak River tributaries having small catchment basin, particularly if they are in the low-lying area. During heavy rainfalls they turn into vigorous mudflows, which transfer large quantities of alluvium and accumulate them near the inlets of culverts the bridges placed on the road, often blocking them. It should also be mentioned that floods also change during a day. There is less flow in the afternoon, and in the evening it reaches the maximum size.

63. Debed River valley deserves a special attention. It begins in the lower reach of Pambak River up to Debedashen, and then it gradually merges with Sub-Kura plane. The upper part of the valley up to Tumanyan station is developed on the volcanogenic-sedimentary rocks of Eocene age, and from Tumanyan up to lower reaches - in the rocks of Jurassic

age. The valley is wide in the upper section, it has a trapezoidal cut, and in the lower section it is a typical canyon developed in the lava cover. The canyon depth in some places reaches 500 m. The left slope of the valley is distinguished by intense course of contemporary exogenic processes (mud flows, landslides, rockfalls, and slope denudation). On the right side the slopes are mostly forested. The higher parts of mountain slopes are covered by subalpine meadows. Lower Alaverdi town the valley gradually expands, and the total section becomes trapezoidal. In many places the floodplain and the lower terraces are seen. The alluvial cones are widespread, especially in the delta of mudflow streams.

e. Water Quality

64. There are two rivers that are situated in the project implementation area-Pambak and Debet. The Pambek is a tributary of the Debed. The southern section of the alignment flows alongside the Pabak River to a point immediately south of Tumanyan where it is joined by other rivers to form the Debed river that runs alongside the northern section of the alignment upto and beyond the border with Georgia.

65. **Pambak River**. Chemical quality of the Pambak River in its upper stream, in the upper part next to the Hartagyugh village is “good” and is graded category 2 (not influenced by the alignment). It is “average” quality in the parts situated below Spitak city and above Vanadzor city and is graded category 3, upstream so not influenced by works on the alignment. It is conditioned by the nitrate ion and total inorganic nitrogen below Spitak city and by nitrate ion above Vanadzor city. Chemical quality of the Pambak river’s water quality below Vanadzor city is “poor” and graded category 5 conditioned by the ammonium ion.

66. **Debet River.** Water of the Debet River below the Martsiget inflow discharge is of “good” quality and graded category 2, this represents the upper section of the Deben around tumanyan. The water quality of Debet river above Ayrum and near the border is “dissatisfactory “and graded category 4 which is conditioned by the presence of molybdenum[8].

67. **Summarising**, From Vanadzor the Pambak river quality is rated as poor (category 5) primarily due to Ammonia pollution[9], potentially domestic, industrial or agricultural pollution. At Tumanyan the Pambak joins and becomes the Debed River. The Debed river is graded as dissatisfactory above Ayum (Category 4) due to the presence of Molybdenum. This may be due to copper mining upstream. In terms of the project it would be prudent to carry out pre and post project monitoring supplemented by daily inspection at key bridge sites.

f. Geology/seismology

[8] Molybdinum has a high melting point and is used in making many types of steel alloys. It can be produced as a byproduct of copper mining.

[9] Ammonia can be from natural factors such as algal growth, decay of plant or animal material, and fecal matter. It may also come from domestic, industrial or agricultural pollution, primarily from fertilizers, organic or fecal matter.

68. Along the section of the road passing through **Lori** region, there are widespread effusive rocks of magmatic complex represented by basalt and andesite-basalt. The project area in Tavush region is located within the lava plateau, inter-crossed by the valley of the river Debed. The geological structure of the region and area, according to the available studied materials, is represented by volcanic rocks of Middle and Upper Jurassic, covered by Cretaceous and Quaternary formations, in places cut through Quaternary intrusions. The Quaternary formations are represented by lavas of basalts, in places covered by modern alluvial-delluvial, alluvial-prolluvial formations of macro-fragmental argillo-arenaceous composition.

69. Lori region is located in the basin of river Debed and has mountainous relief. The mountainous ranges of Javakh, Bazum, Pambak, Gugarats, Virahayots and Halab, depressions of Pambak and Lori as well as Lori canyon are located in the region. Tezh Mountain (3101 meters above sea level) is the highest peak in the region; and the lower reaches of Debed River are the lowest point in the whole country (about 380 meters above sea level).

70. **Tavush** region is located on the external slopes of Small Caucasus mountain chains (Virahayots, Gugarats and Miapor Mountains). Over 40% of the area is occupied by forests, where large diversity of fauna and flora species is observed.

71. According to seismicity map of the territory of Armenia, the area along the project road in Lori region belongs to the II zone with seismicity factor of VIII-IX. Area where the road is passing in Tavush region is located in first seismic zone, where the acceleration is 0.2 g, and the seismic activity is VIII points.

ii. Ecological Resources

a. Flora

72. Lori is considered among the greenest places of the republic with large areas covered with forest, about 62% of total amount of forest in Armenia is located in the northeast part of the republic mostly covered with oak, beech, and pine trees. Armenia has over 3,500 species of plants, while more than half of the 6,000 that can be found in the entire Transcaucasia region. The region of Lori has the variety of plant-life spread on the various zones and altitudes, including mountainous plateau, alpine zone, mountain steppe terrain, subalpine meadows, river valleys and semi-desert steppes. Dozens of fruits (wild relatives of cherry and blackthorn), nuts, melons (wild lentil) and berries (especially woodland strawberry and rheum and bilberry) are also native to this region. Native to Armenia are the apricot and peach. Other fruits that grow include apples, pears, cherries, plums, pomegranates and an amazing variety of grapes. Flora of the Tavush region is represented by meadow-steppe, forest and xerophilous types of vegetation. The area is rich in useful and endemic flora and fauna species. There are also species registered in the Red Book.

73. The vegetation includes the following species: medicinal plants are represented by oregano (Origanum vulgare), the European Cornel (Cornus mas), common yew (Taxus baccata), European crabapple (Malus sylvestris), pomegranate (Punica granatum), Persian walnut (Juglans regia), European Bird Cherry (Padus racemosa), wild raspberry (Rubus idacus), woodland strawberry (Fragaria veska), Sicilian sumac (Rhus cariaria), Jamestown weed (Datura stramonium), while endemic species are represented by

malvaceae (Malvaecae), Genera Alcea (Alcea grossheimii). Species registered in the Red Book of Armenia include date plum tree (Diospyros lotus), trifolium (Trifolium sebastianii).

74. In order to characterize the flora along the alignment a local arborist[10] was engaged to carry out a survey of trees adjacent to the M6 Vanadzor – Alaverdi – Georgian Border Interstate Road and produce a Report of the Findings. The report is presented in Appendix 3: Plant species Along the M6 Vanadzor – Alaverdi – Georgian Border Interstate Road. The survey was carried out in February 2016by report A list of the roadside vegetation was included in the report with species defined in English, Latin (scientific name) and Armenian language. The survey was reported in four distinct sections:

- Section 1 – Urban sections (Vanadzor 0 to 6.5Km and Alaverdi 50.8Km to 54Km);
- Section 2 - Vanadzor to Alaverdi (6.5 to 50.8Km);
- Section 3 – Alaverdi to Qarkop (54Km to 77 Km); and
- Section 4 – Qarkop to Bagratashen / Georgian Border (77Km to 91Km).

Table 10 Tree survey of the Vanadzor – Alaverdi – Georgian Border Interstate Road

Section	Description	Chainage	Affected botanical features	Actions
1	Urban (Vanadzor and Alaverdi);	0Km to 6.5Km 50.8Km to 54Km	Trees between 15 to 20 cm diam	**Pruning** branches
2	Sub-urban Vanadzor to Alaverdi	6.5Km to 38.45 (EIB section)	Generally tree stumps are outside alignment, but branches are within alignment and need pruning.	**Pruning** branches.
		38.45 to 50.8Km (ADB section)	Exceptions: (i) Km7 False acacia (10cm diam);	(i) **Cut** false acacia tree (Km7)
			(ii) pine (Acer plantation) 5 – 15 cm diam about 15 affected; (	(ii) **Cut around 15** Acer platanoides (Km 18/19)
			(iii) Salix Alba needs sanitary pruning at Vahagnadzor bridge inside bridge working area;	(iii) **Sanitary pruning** for Salix Alba **Pruning** of sea buckthorn bushes

[10] Dr Ivan Gabrielyan, Department of Higher plant Systematic and Geography, Institute of Botany of NAS RA

			(iv) Trees at Vahagni (10cm diam) need to be cut – inside rockfall protection works; and	**Cut** approx. 3 trees of about 10cm diam. Not identified in Red Book or special status
			(v) 3rd Tunnel and bridge. ~11 trees of 10- 20cm need to be cut, within construction zone of tunnel and bridge. No special status.	**Cut** approx. 11 trees of 10-20cm diam. Not identified in Red Book or special status
			(vi) Along the alignment bushes will need to be cleared.	Bushes along the alignment will need to be cleared.
3	Sub-urban Alaverdi to Qarkop	54Km to 77 Km	No woody vegetation in this section. Bushes and young trees	(i) No woody vegetation affected. (ii) Removal of young trees & bushes.
4	Sub-urban Qarkop to Bagratashen / Georgian Border	77Km to 91Km	Woody forms rare and small in size. Bushes and shrubs	(i) Removal of young trees & bushes.

75. The surveys identified 48 species, 31 genera and 21 families (see list in Appendix 3). The surveys have not identified any plants identified in the Red Book of Armenia, or rare, endemic, reduced distribution, endangered or having other special status. Generally the works will only affect young trees and bushes that will require pruning and / or cutting.

a. aquatic biology

76. The recent data on aquatic biodiversity of Armenian rivers is very limited (often not even well- studied), only some near-border sections of river Debed were partially studied, which included determining species composition. The following fish species are registered in Debed River: salmo trutta trutta, barbus lacerta cyri, chondrostoma cyri, capoeta capoeta. It should be also noted that the process of natural development of fish families in Debed River is violated, since due to construction of several weirs along the river for irrigation water intake without fish passes and fish protection structures, fish cannot swim upstream to spawning areas during the reproduction season.

b. Wildlife

77. **Lori** region holds a large diversity of animals; most notable species are sylvan wildcat, reed wildcat, lynx, fox, royal stag, deer, Caucasian squirrel, porcupine, bear, wild bore, and marten. Lori is also hosting a wide variety of bird species native for mountain plateaus

and craggy mountains as well as for the woodlands and mountain forests. It also supports bird species residing in river gorges and semi-desert steppes. The mountain plateaus and sweeping alpine areas are habitats for the a number of varieties of eagles (Greater Spotted Eagle, Steppe Eagle, White Tailed Eagle, Golden Eagle, Imperial Eagle, Booted Eagle, etc.), hawks (Northern Harrier), sparrows (Buntings), bee-eaters, owls, cranes, storks, crakes, pheasants, bustards, larks, rollers, warblers, swallows, redstarts (Black Redstart, White-winged Redstart), lammergeyers, Eurasian Black vulture, Eurasian Griffon and other species. Woodland birds include hawks, woodcocks, cuckoos, owls (Eurasian Scops Owl, Tawny-Owl, Long-eared Owl, Boreal Owl), woodpeckers (Eurasian Green Woodpecker, Black Woodpecker, Lesser Spotted Woodpecker, Middle Spotted Woodpecker, Great Spotted Woodpecker, White-baked Woodpecker), francolins, doves, larks, warblers, pipits, starlings, finches, jays, rooks, wrynecks, flycatchers, etc.

78. **Tavush** region is characterized by the following fauna species: Lepus (Lepus europaeus), jackal (Canis aureus), jungle cat (Felis chaus), red deer (Cervus elaphus), Europian roe deer (Capreolus capreolus), wild hog (Sus scrafa), Brown bear (Ursus arctos), wild cat (Felis silvestris), Squirrel (Sciurus persicus), Badger (Meles meles), Common quail (Coturnix coturnix), Chukar (Alecotris graeca), red fox (Vulpes vulpes), Wolf (Canis lupus), stone marten (Martes foina). Species registered in the Red Book of Armenia include: Mediterranean turtle (Testudo graeca), White tailed eagle (Haliacetus albicilla), Bluethroat (Lucinia svecica), Imperial eagle (Aquila helica), Stream trout (Salmo fario), Kurian bleak (Albumus filippi), Common Bleak (Albumus alburnus), Spirlin (Albumoides bipunktatus), Chub (Leuciscus cephalus), Golden Spined Loach (Sabanejewia aurata; Angora Loach (Nemacheilus angorae), Stone loach (Barbatula barbatula), Brown trout (Salmo trutta)

c. Forests

79. Forested areas occupy space in Debed River valley and they extend from 500 to 2200 m heights. The important tree species in the forest are: beech, oak, hornbeam, lime tree, ash tree, etc. Here the tree height can reach 20-30 m. The wild fruit trees - wild pear, walnut, apple, plum, and cornelian occupy a significant place in the lowland of the forest zone. Out of grassy-shrubby plants blackberries, rose hip, etc. dominate.

80. There are forested areas in Pambak River tributaries - Tandzut, Vahagni, Vahagnadzor, Alareks basins. The subalpine and less widespread, alpine meadows lie above the forested zone with their specific plants, particularly flowers. It should be noted that it is characteristic for both the vegetation of black soil areas and the felt-like layer of forest zone humus horizon to decrease the surface flow tension. The surface runoff is significantly higher than the subsurface runoff in these zones. There are very few sources, with small outlets. The river network formed in the area is fed due to rainfall and meltwater.

d. Rare or endangered species

81. Current investigations have not identified any rare or endangered species likely to be affected by works on the alignment.

e. Protected areas

82. Armenia has a system of protected areas categorized as:

- national parks (4);

- state reserves (3); and
- state sanctuaries (26).

83. There are no protected areas on or close to the alignment. The Rhododendron caucasicum Sanctuary/ Preserve and Margahouit Sanctuary / Preserve are over 30Km from the alignment to the south east of Vandzor. There is also the Gyulagrak Sanctuary / Pine Preserve but that is over 30Km west of the alignment.

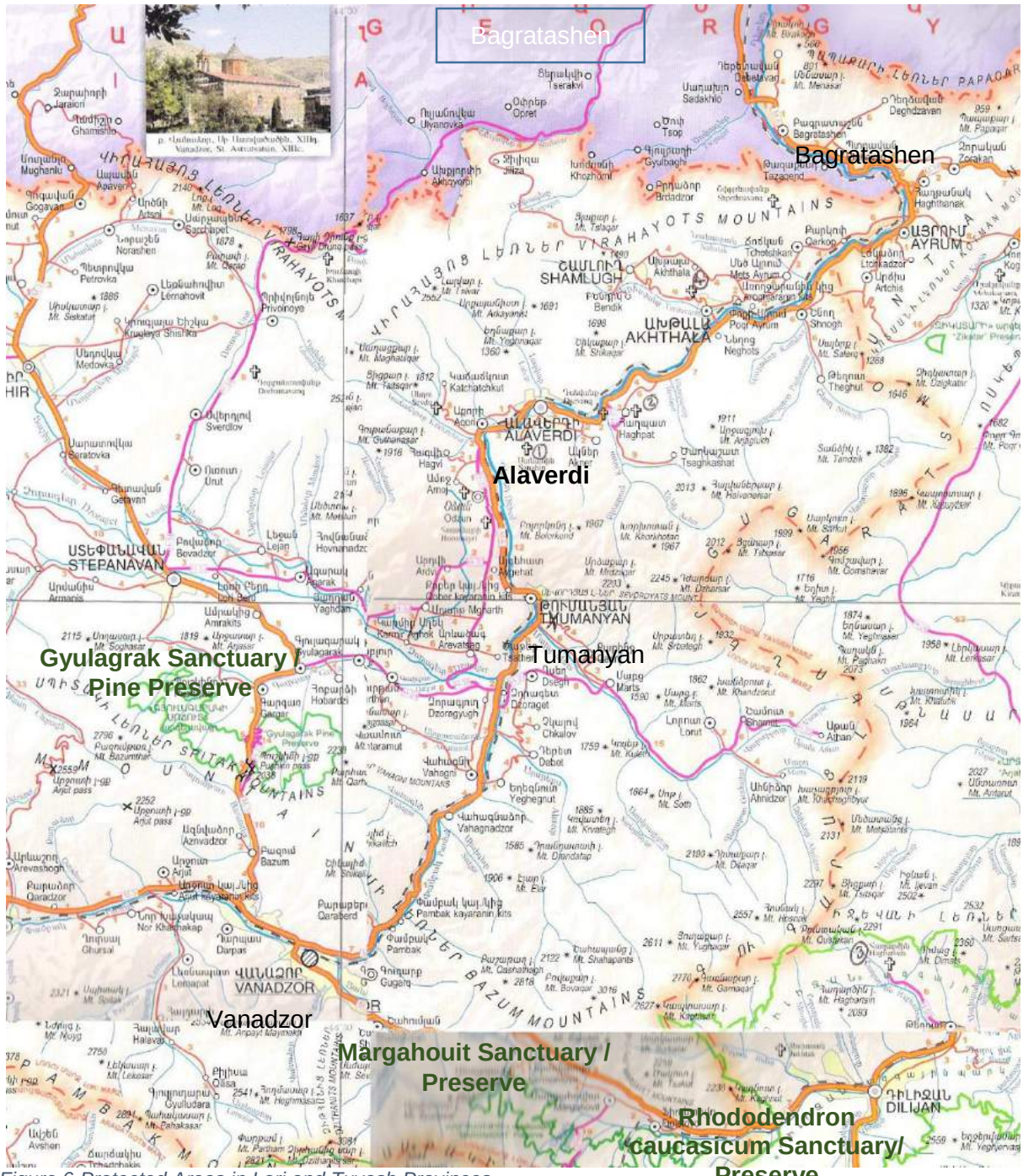


Figure 6 Protected Areas in Lori and Tuvash Provinces

iii. Economic Development

a. Industries

84. Though much reduced in production since the collapse of the Soviet Union, mining and its associated chemical and metallurgy industries remain the leading industries in the area in terms of employment and production. Light industry has declined and food production has increased.

85. The city of Vanadzor is the main industrial centre of the province. It has 2 large clothing and sewing firms, 2 building materials and reinforced concrete manufacturing enterprises, and a polymer composite production enterprise. With its large chemical plant, Vanadzor used to be a major centre of chemical products during the Soviet period. However, the only surviving plant is the "Vanadzor Chimprom" company for chemical and biochemical products.

b. Transportation

86. **Road**: The M6 is the major road corridor in the area, providing a link to the border with Georgia and linkages between the town and villages in the Debed Valley.

87. **Rail:** Except with Georgia, all international railway links between Armenia and its neighbors have been closed since 1993 due to the blockade against the country by Turkey and Azerbaijan. The electrified connection to Tiblisi runs parallel to the alignment.

88. **Air**: There is a regional airport at Stepanavan in Lori province, northwest of Vanazdor. It is located 6 km (3.7 mi) northwest of the center of Stepanavan. The airport is under renovation and is envisaged to be ready by 2016 The airport operates an exchange agreement with Doncaster Sheffield Airport in the United Kingdom, whereby staff from both undertake short periods of training at the corresponding airport.

89. Mountain scenery, combined with a mild summer climate and the forests of Lori attract a large number of visitors during the summer season. Many sanatoriums, hotels, resorts and spas serve the province, mainly around Vanadzor, Stepanavan, Alaverdi, Dsegh and along the rivers of Dzoraget and Deped (project river).

90. Lori has three nature protected areas and two botanical gardens: the Gyulagarak Sanctuary, the Margahovit Sanctuary, the Rhododendron caucasicum Sanctuary near Aghstev river, the Stepanavan Dendropark, and the Vanadzor Botanical Garden. But all are remote from the alignment (Figure 6).

91. The Monasteries of Haghpat and Sanahin are identified UNESCO World Heritage sites close to Alaverdi but remote from the alignment (Figure 9).

iv. Social and Cultural Resources:

a. Population and communities

92. The project is located in the northern part of the country in the regions of Lori and Tavush.

93. Lori region is situated in the north of the Republic of Armenia Lori is the third largest region by area in the republic and biggest by population. The northern part of the region borders the Republic of Georgia (the international border is 110 km). It borders four regions in Armenia: Tavush region to the east, Kotayk region to the southeast, Aragatsotn region to the southwest and Shirak region to the west.

94. Tavush region is situated in the north-eastern part of the Republic of Armenia. The region is bounded by by Lori, Kotayk and Gegharkunik marzes to the west and to the south, Republic of Georgia to the north and Republic of Azerbaijan to the east. Tavush region has 400 km of Armenia's national border, of which 352 km is with Azerbaijan. Only a small section (about 15 km) of the project road passes along Tavush region's western border towards the border with Georgia.

a. Socio-economic conditions

95. During[11] the Soviet era the Lori region had a powerful industrial base comprising all industry sectors. The industrial base employed more than 53,000 people, 30,000 were employed in Vanadzor. Industrial enterprises exported their products to more than 45 countries. Since the collapse of the Soviet Union, industry in the region has weakened considerably.

Figure 7 Copper processing plant in Vanadzor

96. Although chemical and metallurgy industries remain leading branches in terms of the production, volume machinery and equipment construction spheres as well as light industry lost their leading position and the share of food production has increased. During recent years increase in electricity power has been noted.

97. New mining industry enterprises have been established recently and their production volumes have increased. In terms of production volumes the metallurgy subsector has the prevailing role in the industry structure (86%) followed by food industry, the volumes of

[11] Information sourced from the EIB M6 VAG Environmental and Social Impact Assessment Report.

which, however, are 14 times less than metallurgy. According to production volume the main industry is focused on Tumanyan province.

98. Vanadzor has about 50 enterprises with about 2500 employees. 6 enterprises operating in the region are large and 120 enterprises are small and medium size production units (SME), which involve only 30% of employees involved in the industry. 40% of (SME) production units are processors of agricultural products and food production enterprises. The majority of Lori population is involved in agriculture, namely livestock, husbandry, horticulture and beekeeping. The region also has stone and wood processing plants, electricity and other enterprises. Lori region has a number of banks and financial and credit organizations. The region has mass media (TV, newspapers) and NGOs. There are trade and service delivery centers, the majority of which are located in the regional center and big towns. There are also hotels and guesthouses. However, it should also be noted, that the level of unemployment in the region is high. As a result of unemployment there has been migration from the region to work abroad (mostly males). Main institutions ensuring employment for men in communities are industrial enterprises (if there are any), farming, small and medium size enterprises, municipality and regional government (marzpetaran). Women are mostly employed in education, healthcare, service delivery facilities, farms, small and medium enterprises, municipality and regional government (marzpetaran). Business development in the region focuses on tourism, the mining, electricity production, metallurgy, information technologies and chemical industry, processing agricultural products, light industry, food industry, machinery and equipment production.

99. **Tavush region** is one of the main agricultural districts of the republic. The share of economy main branches of Tavush region in total volume of agriculture of the republic comprised 4.8%. In animal husbandry the main activities are cow and pig breeding while in plant growing the most developed branches are grain and grape growing. Programs have been implemented for recovering orchards. During recent years beekeeping has developed. The main branch of economy of the region is manufacturing. The food industry and woodworking continue to be the leading branches of industry. Wine, mineral waters, stone and wood products are exported to external markets. The region is comparatively poor with few useful minerals. Freight and passenger transportations in the region are implemented by road transport. 146 km interstate, 253 km of republican importance roads are extended through the region. 70 km part of Ijevan-Hrazdan railway goes through the Aghstev gorge. 7 km part of Yerevan-Tbilisi railway goes through the Northern border lengthwise, Debed bank. The Northern Caucasus-Tbilisi-Yerevan gas-line goes through the region center.

b. Physical or cultural heritage

100. Though the region holds two UNESCO World Heritage listed monasteries in the area (Haghpat and Sanahin) they are remote from the alignment and will not be affected by the construction or operation of the M6.

101. There are two cemeteries adjacent to the alignment. The first is on the LHS of the road at Km4 in Vanadzor and the second is on the RHS of the road at Km52 in Alvardi

Figure 8 Cemetery adjacent to the alignment in Vanadznor (Km 4.5)

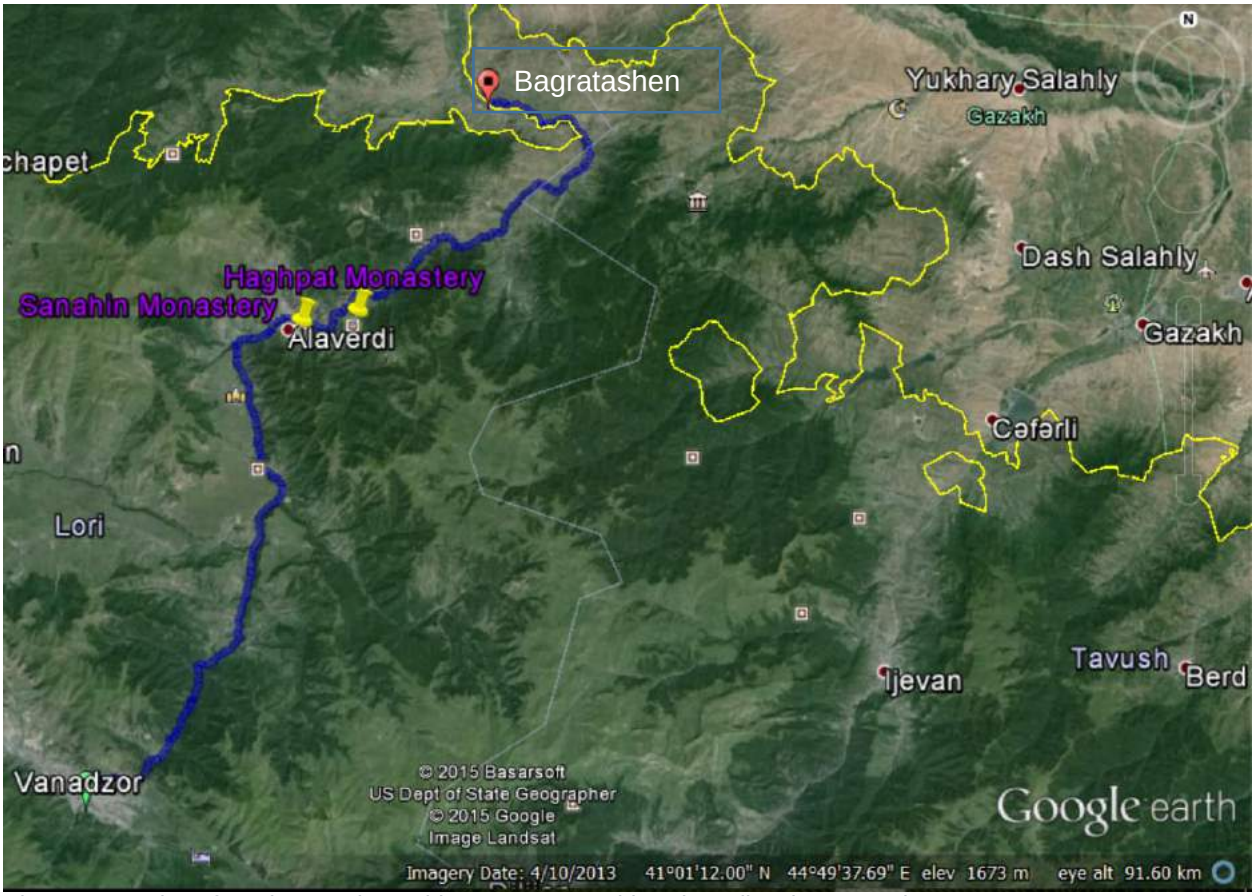


Figure 9 Location of Haghpat and Sanahin UNESCO World Heritage listed monasteries

102. The M6 project will impact on a number of small monuments and memorials located along the road. Though these are generally installed to memorize the victims of accident they are identified here. The monuments including water springs and fountains, memorial stones, statues, cross stones, etc. It is understood that they will be relocated to the new locations in accordance with the agreements with relatives and local authorities, as applicable. The list of monuments located along the project road is provided in the following table.

Table 11 List of monuments and memorials located alongside the alignment

No	Description	Km	Location

1.	Cemetery	66+00 -79+40	40m left from the road
2.	Spring	70+12	4m left from the road
3.	Spring	82+64	7m right from the road
4.	Spring	85+80	15m right from the road
5.	Memorial stone	106+67	14m right from the road
6.	Spring	106+71	16m right from the road
7.	Memorial stone	106+83	15m right from the road
8.	Memorial with water fountain	109+50	31m left from the road
9.	Memorial water fountain	113+48	7m left from the road
10.	Memorial with water fountain	133+95	12m left from the road
11.	Cross stone	139+56	25m left from the road
12.	Memorial with water fountain	139+66	30m left from the road
13.	Spring	149+0.96	7m left from the road
14.	Memorial with water fountain	153+33	17m left from the road
15.	Monument	175+20	6m left from the road
16.	Monument	203+27	13m left from the road
17.	Memorial with water fountain	222+28	15m left from the road
18.	Memorial stone	245+34	6m left from the road
19.	Memorial stone	246+23	10m left from the road
20.	Spring	250+28	24m right from the road
21.	Spring	262+82	13m left from the road
22.	Memorial stone	273+48	21m left from the road
23.	Spring	281+40	13m left from the road
24.	Spring	323+14	15m right from the road
25.	Memorial with water fountain (Morqur)	327+60	8m right from the road
26.	Spring	327+81	8m left from the road
27.	Memorial with water fountain	330+48	6m left from the road
28.	Memorial with water fountain	335+78	5m left from the road
29.	Memorial stone	346+51	8m left from the road
30.	Memorial with water fountain	347+94	6m left from the road
31.	Memorial stone	352+24	8m left from the road
32.	Memorial with water fountain	360+85	17m left from the road
33.	Memorial with water fountain	364+52	11m left from the road
34.	Memorial with water fountain	366+24	15m left from the road
35.	Memorial with water fountain	369+32	7m left from the road
36.	Spring	379+17	10m right from the road
37.	Memorial with water fountain	381+70	10m right from the road
38.	Memorial with water fountain	395+56	5m right from the road
39.	Memorial stone	429+23	18m right from the road
40.	Memorial with water fountain	467+75	11m left from the road
41.	Alaverdi monument	470+17	10m right from the road
42.	Spring	490+83	8m left from the road
43.	Statue	506+80	13m left from the road
44.	Spring	529+62	6m right from the road
45.	Water fountain	534+71	8m left from the road
46.	Memorial stone 5	549+00	6m right from the road
47.	Cemetery	554+80 -560+20	From the right
48.	Memorial with water fountain	582+50 – 582+60	13m left from the road
49.	Spring	607+40	17m left from the road
50.	Memorial stone	631+60	8m left from the road
51.	Cross stones	638+70 –639+00	13m left from the road
52.	Memorial stone	650+30	8m left from the road
53.	Monument	665+78	9m right from the road
54.	Monument	667+42	10m left from the road
55.	Spring	763+52	6m left from the road
56.	Monuments	779+90 -780+10	left from the road
57.	Monument	788+30	11m right from the road
58.	Memorial stone	878+67	5m left from the road

Information obtained from the EIB Feasibility Study, Environmental Impact Assessment (EIA) and Detailed Engineering Design. Note that the Km records are at variance with that observed at site.

E. Anticipated Environmental Impacts and Mitigation Measures

i. Due Diligence Review of Potential Environmental Impacts

103. At the commencement of the environmental study a due diligence review was undertaken on all project components and a Rapid Environmental Appraisals (REA) prepared (Appendix 1). The due diligence entailed:

- Site visits on the proposed alignment of M6 and preparation of an "alignment sheet" describing key sites on the alignment (Appendix 2).
- Review of documents specifically the "Feasibility Study, Environmental Impact Assessment (EIA) and Detailed Engineering Design of the rehabilitation and improvement of M6 Vanadzor – Alaverdi –Georgian border interstate road" prepared for the European Investment Bank (October 2015)
- Review of project information provided by the PIU
- Professional opinion and experience of International Environment Specialist
- Preparation of REA
- Confirmation with ADB regarding the methodology and presentation of the IEE study
- Preparation of an Environmental Management Plan (EMP)
- Discussions with ADB project officers including environment specialist

104. Findings are summarized below:

- The proposed alignment upgrading will be within the boundaries (footprint) of the existing road
- There are four distinct sections to the project: two urban sections at Vanadzor and Alaverdi where works will be confined to milling of the existing road and improvements to street furniture to improve road safety; a rural / canyon section between Vanadzor and Alaverdi where significant upgrading works will be required to bridges, tunnels and rockfaces; and the northern rural section where works will be limited to milling of the existing road surface and installing rockface protection.
- None of the alignment footprint falls within or close to any protected areas or culturally sensitive areas though there are numerous small memorials erected by members of the public on road verges.
- Based on site observation the overall project is likely to give rise to negligible or at worst, minor temporary environmental impacts that can be easily mitigated.
- The most significant potential environmental impact will be associated with the noise and dust associated with the removal of the existing road surface and silty runoff, or hydrocarbon, chemical or grease spills from the works.

ii. Summary of Potential Environmental and Social Impacts

29. In general, the potential adverse environmental and social impacts associated with the works to carried out on project road mostly within the existing alignment are expected to be small, short-term and localized.

30. The majority of the potential adverse impacts will be applicable during the construction/rehabilitation period only and will mainly occur within the road corridor and

sections where the works are implemented. The likely adverse environmental impacts during the construction phase will include, but not be limited to the following:

- degradation of soil, landscape and soil erosion due to improper disposal of excavated materials and construction waste;
- spillage of fuel (hydrocarbons) and chemicals associated with construction during the construction period;
- pollution of water resources from accidental spills;
- use of temporary construction sites (camps, machinery sites, storage facilities, etc.);
- use of borrow pits;
- temporary air pollution related to increased truck traffic during the construction;
- noise and vibration disturbances from vehicle movements and operation of construction plant.

31. The positive socio-economic and environmental impacts of the road rehabilitation works are expected to be significant, since the Project will provide:

- reliable connection;
- speedy and safe movement of passengers and cargo;
- reduced operation and maintenance costs of the road infrastructure as well as vehicle maintenance costs for population and businesses;
- reduced emissions from vehicles due to improved road features and intact surface (reduction of number of acceleration and deceleration cycles);
- new employment opportunities (including temporary employment during construction phase);
- improved access to health, education or social infrastructure;
- better opportunities for farming and industry product;
- reduction of migration from rural areas.

32. The expected overall positive environmental and social impacts from the proposed project will be long-term and cumulative in nature, ultimately contributing to the increased social and economic benefits of the communities affected.

33. The potential adverse environmental and social impacts for construction and operation phases are described below for the construction and operation phases.

c. Construction phase impacts

34. **Degradation of landscapes and soil erosion**. Some of the areas are sensitive to soil erosion; therefore, when undertaking earth works and levelling the area anti-erosive measures will be implemented during the recultivation period.

35. **Generation of excavated materials and construction wastes**. Demolition debris will be generated during the rehabilitation/construction works on road and associated infrastructure. These effects will be localized, and will be minimized by means of appropriate removal and disposal procedures.

36. **Impacts from temporary access roads and work sites**. Establishment of temporary earth roads to bypass the sections of the works where construction works are being implemented as well as to access construction materials storage and waste temporary

accumulation sites, camps, machinery sites, storage facilities can enhance soil erosion, and degrade the landscape;

37. **Pollution by construction run-offs**. As a result of oil leakage from machinery and stock piled construction materials and asphalt, oil products and chemicals can penetrate to the soil and/or ground water or run off to water recipients.

38. **Impacts on biodiversity**. No major impacts on biodiversity are expected due to rehabilitation of road within the existing alignment, since the road was built and intensively operated for several decades now and throughout this period ecosystems were significantly transformed and already carry significant anthropogenic footprint. During construction there may be damage to the plant cover and the habitat for wild life could be disturbed/ spoiled in the cutting and filling areas along the road alignment (in case the decision is made to reconstruct the road and bring it to the acceptable standards). Earth borrowing, mining of local aggregates and spoils disposal sites will have a temporary negative impact on the environment. For these sites already used quarries should be selected to minimize the impact both during the construction and later during operation.

39. **Noise, vibration, and emissions**. Noise, vibration, and emissions will be generated in the course of the transportation of construction materials and truck traffic. Emission of inorganic dust from digging-loading works, emission of harmful substances and dust from combustion of diesel used by transportation means and machinery, as well as bitumen smoke arising from road construction work occur during the construction works. Welding works cause welding aerosol and manganese monoxide emissions. Concrete mixers work result in concrete dust emissions. If mobile asphalt plants are used they could cause negative impact on water, ground water and air if not properly managed. This type of asphalt plant should be avoided. All asphalt plants should be certified and inspected according to Armenian norms before they are allowed to be used for the rehabilitation.

40. **Dust** arising from construction works will have negative impact on the ambient air quality, and it is necessary to take effective protective measures to minimize the negative impact, especially in settlements and protected areas.

41. **Disposal of excavated materials and construction wastes**. Demolition debris will be generated during the rehabilitation/construction works on roads. These effects will be localized, and will be minimized by means of appropriate removal and disposal procedures, which may include but not be limited to careful selection of waste temporary accumulation sites, clear delineation of these sites to exclude their expansion, prevention of washout of such sites, obtaining written agreement on permanent disposal site with local authorities and timely transportation of waste to the designated dump site.

42. **Safety hazards from construction activities**. Safety hazards can occur due to violation of proper health and safety practices and may lead to injuries and accidents. No major hazards are expected during construction of the proposed project elements as long as proper construction practices and safety procedures are applied.

43. **Community health and safety**. The project may change the community's exposure to risks and impacts arising from accidents and structural failures. Impacts on the health and safety of the community may also arise during construction as a result of noise, dust and other emissions from earthmoving, blasting, piling, and operation of equipment and vehicles. The negative social impacts of the project arising during construction however

can be mitigated through correct organization of the construction process and implementing suitable mitigation measures.

44. **Impacts on population**. Impacts on population and occupation are expected to be in general positive. Road rehabilitation will have certain impacts on demographic structure of labor force in the area affected by the proposed road improvements. It will make it possible for young people to stay in the project area and commute to work. The rehabilitated road will increase the access to markets for local producers and promote development of the agricultural sector, tourism and in some cases development of local industry. Furthermore, the improved road will give access to new employment. The economic development will help to get more investments in public utility facilities, energy, telecommunications, education, public health, cultural and entertainment, etc. The rehabilitated road section will lead to a reduction of vehicle operating costs, which also will have a positive effect on the private economy of car owners.

45. **Resettlement/ land acquisition/ compensation**. No resettlement is expected during project implementation since major works consist in rehabilitation of existing infrastructure. However, based on the final design and decisions to be made with respect to bringing the existing road upto necessary national standards, some land acquisition and resettlement may be necessary. While carrying out final design, the approach will be to avoid or, at least, minimize, project-induced resettlement.

46. **Impacts on historic-cultural and archaeological monuments**. No archaeological or cultural resources are expected to be encountered during project implementation since major works consist in rehabilitation of existing infrastructure, where excavations have been conducted before and no findings have been reported. There are some monuments (water springs, fountains, cross stones, etc.) installed along the project road that mostly commemorate the victims of traffic accidents – these monuments will be relocated during implementation of civil works to places agreed with the owners of the monument and local authorities, as required on a case by case basis.

47. **Impacts on utilities and infrastructure**. Based on the current design, the proposed construction works may impact on utilities and infrastructure located nearby or under the road, including gas pipes, electric and telecommunication cable, fibre optic cables, water and wastewater pipes, irrigation systems, storm water sewers, pedestrian crossings, passes for cattle and agricultural machinery, etc.

48. Site Specific Impacts (1) Construction camps will contain offices and accommodation for works staff, maintenance areas and perhaps manufacturing areas- crushing plant and asphalt plant. Environmental impacts include noise from maintenance areas and any crushing plant, dusty works (from vehicle movements and operation of manufacturing equipment) and potential for adverse water impact due to runoff from unmage roads, oily runoff from manufacturing and storage areas and sewerage discharges.

49. Site Specific Impacts (2) Bridges. There are twenty nine existing bridges and culverts on the alignment but only six sites are identified for bridge reconstruction. These sites are the most vulnerable to adverse environmental impact on the rivers that they cross from (i) construction material being deposited in the river below or (ii) during works within the river. However the current construction design envisages minimal work in the river and construction focused on reconstruction of the bridge deck. Other impacts include general

construction noise, dusty works and potential for both silty and oily runoff. The following table identifies the bridges identified for reconstruction.

Table 12 Bridges on the alignment needing Reconstruction Works

Bridge No	Km	EIB / ADB	Improvement	Notes
4	20+626	EIB Section	New Bridge	
9	31+647		New Bridge	Realignment
19	47+925	ADB Section	New Bridge	Realignment
24	61+825		Only Deck	
27	71+813		Only Deck	
28	76+436		Only Deck	

Source: Final Engineering Report (Oct 2015) Section 11.3

50. Site Specific Impacts (3) Tunnels. There are three tunnels on the alignment. Two will only be upgraded and one will require significant reconstruction. Environmental impacts include general construction noise including drill and blast work, dusty works (particularly portal emissions from extract fans) and potential for both silty and oily runoff. The details of the tunnels are presented in the following table. All bridges are within the EIB project area. There are no bridge reconstructions in the ADB funded project.

Table 13 Tunnels on the alignment

Tunnel No	Km (Start)	Issues	Actions
1	24+866	Height below standard	Lower carriageway by about 0.6m (drill & blast), install curbs, asphalting and install lighting. New entrance portal
2	30+579	Unlined, dimensions below standard	Drill and blast, install concrete lining to ceiling and walls, curbs, asphalt and lighting. New entrance portal
3	31+287	Height below standard	Lower carriageway by about 0.6m (drill & blast), install curbs, asphalting and install lighting. New entrance portal

Source: Final Engineering Report (Oct 2015) Section 11.3

51. Site Specific Impacts (4) Borrow and Disposal Areas. Borrow pits will be needed for the production of construction material (fill and aggregate) and site will also be needed for the disposal of unsuitable materials, they may serve both functions at different stages in the project. Environmental impacts include noise and dust impact, silty runoff and loss of habitat. However, it is currently envisaged that the project will use established borrow sites and will not require the opening of new sites. The existing sites are operated to the requirements of their licences, issued by the appropriate national government and local authorities. There are specific conditions in relation to environmental performance.
52. Site Specific Impacts (5) Road construction. The reconstruction works will require the removal of existing road material (full removal to base or just milling of the surface) and the engineered reconstruction of the road. Environmental impacts include construction noise, dust, silty and hydrocarbon runoff and loss of habitat (including trees).
53. Site Specific Impacts (6) Fixing of rockfall protection / stabilization. Works include, drilling and blasting, dislodging unstable rocks and soil, erection of nets and walls. Environmental impacts include noise impact (drill and blast), air quality (dust), water quality (silty runoff)

and potential for hydrocarbon and chemical runoff from vehicle operations) and habitat loss (young trees).

Table 14 Summary of Construction phase impacts

	Noise	Air Quality		Water quality			Ecology	
		dust	vehicle emissions	silty	hydrocarbon	chemical	habitat	trees
1 Construction Camp	☑	☑	☑	☑	☑	☑	☑	☑
		Manufacturing area		& sewage	Manufacturing area			
2. Bridges	☑	☑	-	☑	☑	☑		
				Discharge to rivers				
3. Tunnels	☑	☑	-	☑	☑	☑		
4. Road construction	☑	☑	☑	☑	☑	☑	☑	☑
		milling	minor		minor	minor		
5. Borrow Disposal	☑	☑	-	☑	-	-	☑	☑
			Minor					
6. Rockfall protection	☑	☑	-	☑	☑	☑	☑	☑
			minor		minor	minor		

d. Operation Phase Impacts

54. **Impact on provision of transportation services**. Rehabilitation of the road infrastructure will result in significant improvement of provision of transportation services and will allow to ensure reliable, safe and speedy transportation of passengers and goods without interruptions possible due to the dilapidated state of the existing infrastructure.

55. **Impacts from drainage system**. Operation of the road will require removal of rainwater through drainage system. Improper and non-timely maintenance and cleaning of drainage network can lead to clogging and malfunction of the system, thus contributing to deterioration of pavement and worsening of sanitary-hygienic conditions in road area.

56. **Impacts from waste along the road**. Operation of the road will require timely removal of waste accumulated in recreation areas and park and rest zones located along the project road section. Improper and non-timely collection, removal and disposal of waste can lead of odour and aesthetics impacts in the road and nearby area. Other adverse consequences may constitute worsening of sanitary-hygienic conditions due to accumulation of waste.

57. **Impacts from winter maintenance of roads**. Improper and non-timely winter maintenance of road can result on interruption of provision of road operation and transportation services during the cold season of the year. Application of chemicals for road de-icing may impact the soil and water quality and lead to pollution, thus operation and maintenance manuals should establish the approaches for winter maintenance of the road with due consideration of environmental impacts.

58. **Impacts on population**. Impacts on population and occupation are expected to be generally positive. Rehabilitation of major road will have certain impacts on demographic structure of labor force in the areas affected by the proposed project improvements. The project will create temporary and some permanent job opportunities for the local population (both men and women), as they could be employed during rehabilitation and maintenance.

59. **Safety hazards during operation**. Safety hazards can occur due to violation of proper health and safety practices and may lead to injuries and accidents. No major hazards are expected during construction of the proposed project elements as long as proper operation practices and safety procedures are applied. During the operation period negative impact might occur as a result of driving with higher speed. Increased speed and expected higher traffic volumes can increase the number of traffic accidents. To some extent such impacts can be prevented by undertaking appropriate safety measures envisaged in design documents (e.g. installation of warning and speed limiting signs, speed control devices, etc.).

60. **Community health and safety**. Operation of the road will lead to increase in number of vehicles using the road as well as increase in driving speed. This may cause impacts on safety (especially for population residing in communities located on project road), as well as may impact the air quality, due to increase in number of vehicles and consequent increase of emissions.

61. Based on initial observations, all of the mentioned potential adverse environmental and social impacts revealed during scoping process can be prevented and/or minimized as a result of proper and timely implementation of mitigation measures as well as best management practices (identified in the Environmental Management Plan [EMP]) for the project and to be implemented during construction works and further operation of the rehabilitated road.

62. At this stage of analysis it should be noted that the positive social and economic impacts of the reconstruction of M6 Vanadzor – Alaverdi – Georgian border interstate road in Armenia will outweigh potential environmental and social risks, since rehabilitation of the major road of republican and interstate importance will improve safety of road infrastructure and ensure reliable, timely and speedy transportation.

e. Construction Phase Mitigation Measures

63. Mitigation measures that could be used where appropriate (depending on type of road, volume and type of traffic, road surrounding area, etc.) are separately defined for the design, construction and operation phases. Appropriate measures are included in the Environmental Management Plan (EMP).

64. The construction phase is the period when most disturbances to the environment will occur. This will include clearing of vegetation, excavations, establishment of base camps for the storage of fuel, oil, bitumen, chemicals and the emission of dust and noise during working hours at work sites. To minimize potential degradation of landscapes and soil erosion and pollution from disposal of excavated materials and construction wastes, existing quarries for materials will be used where possible and suitable excavated and dredged soils shall be reused in order to limit the need for new quarries. Work areas shall be clearly delineated and closely monitored, so that they do not expand during construction. Workers on the road should be assigned appropriate safety equipment for their personnel security. Dust and noise from the construction site should be minimized where activities are close to sensitive uses. Construction concrete waste, debris and spoils shall be transported and disposed in approved landfills/dump sites. After completion of construction and rehabilitation works landscape shall be restored to quasi-original conditions. Details of proposed mitigation measures are presented below:

65. **Preserving landscapes and minimizing soil erosion**. To minimize degradation of landscapes and soil erosion the Contractor(s) will use, where possible, existing quarries for required additional materials. Suitable excavated and dredged soils will be preferably used, thus limiting the need for old and new quarries. The permits from the Ministry of Energy and Natural Resources and, as needed, from the local regional authorities will be obtained if the opening and/or use of quarries are required. Access roads will be carefully chosen and delineated to minimize impacts on landscape and soil erosion, and will be closely monitored to eliminate their unduly expansion during construction works. After completion of construction and rehabilitation works and after use of quarries, landscape shall be restored to quasi-original conditions, and plant species specific for the project area shall be preferably used.

66. **Managing construction run-off**. Existing access roads will be used where possible, minimizing the need for establishing the new ones. The top surface of access roads and work areas will be compacted to facilitate water runoff and avoid flooding the area. This may require digging drainage ditches and connecting them to natural drainage / rainwater discharge system.

67. Work sites, machinery maintenance areas and construction camps**.** These shall be located away from river to prevent adverse impact on water quality. To reduce the likelihood of oil spillage from construction equipment and fecal contamination from construction camps, sites for these areas shall be carefully designated and well maintained machinery and equipment shall be used. In addition, sand or fine gravel should be spread on the ground in the locations designated for parking, and servicing construction machinery. In case of spillage the contaminated layer should be removed to a designated waste disposal site and the affected area replaced with clean sand or fine gravel.

68. Septic tanks necessary at construction camp(s) shall be made of impermeable material and will be emptied regularly in accordance with applicable rules. The wastewater will be transported by a special truck to a centralized wastewater collector, based on agreement obtained from the local authorities during the design phase.

69. **Preserving biodiversity**. The impact on biodiversity will be minimal, as the works will be carried out within the footprint of the existing alignment. The existing right-of-way will be preferred for establishment of work sites and camps, storage of construction materials, preliminary accumulation of wastes, which will remove impact to the vegetation cover and other components of the environment. Sourcing construction materials from already operating quarries will be encouraged to minimize the negative impacts of new quarries on landscapes and biodiversity. If cutting of trees or tree branches is required to improve visibility conditions and ensure safety, the location and number of trees to be cut will be agreed with relevant state and local authorities prior to commencement of tree /branches cutting works.

70. **Managing noise, vibration, and emissions**. Dust-depressing measures aimed at prevention of air pollution will include watering of access and bypass earth roads and construction sites. During construction, air pollution in the form of dust from earthworks and vehicle emissions will increase. Regular water sprinkling and enforcement of reasonable vehicle speeds during construction will alleviate dust impacts. Dust at construction sites will be minimized by using closed/covered trucks for transportation of construction materials (especially loose construction materials such as gravel, sand, soil, etc.) and debris. To minimize impacts on nearby residents all vehicles will be equipped

with exhaust mufflers and regularly inspected to ensure they are operating efficiently. In addition, works sites will only operate during daytime hours. Other measures planned to maintain good air quality include locating asphalt plants and concrete mixing sites and stockpiles in isolated areas, as well as confining working vehicles to designated routes away from sensitive receivers.

71. **Waste management**. If a vegetated area is used for establishment of construction site, the topsoil will be carefully removed and stored in piles not exceeding one meter and will be used on completion of works for site restoration. Construction concrete rubble, debris and spoil will be transported and disposed in approved disposal sites. Permits from the local regional authorities or contracts with specialized entities will be signed to carry out transportation and disposal of excavated materials and construction waste. Restoration to quasi-original conditions will be carried out after completion of renovation works and after use of quarries.

72. **Managing safety hazards**. No major hazards are expected during the road rehabilitation works, as long as proper construction practices and safety procedures are applied. The work sites and camps shall be clearly delineated (preferably by fence); access to construction sites and camps shall be strictly controlled and limited to authorised personnel. Personal protective equipment must be available and be used during implementation of works. If works require drilling or blasting, the works will be implemented only by specially trained personal using specialized personal protective equipment. In addition, all workers shall receive appropriate orientation and instruction (including first aid training) prior to commencing their involvement in construction works.

73. **Managing waste and wastewater in camps**. Waste containers will be placed near the construction camp and sites to collect the household waste generated during road rehabilitation works. Agreements / contracts will be signed with the appropriate authority / entity to ensure timely transportation and disposal of waste. Wastewater will be discharged into a centralized / dedicated sewerage system. If a centralized sewerage system is not available in the community, wastewater will be collected in a septic tank and periodically removed, transported by specialized organization to a nearby area with a centralized sewerage system and discharged into that system. Rehabilitation works will be carried out in consultation with representatives of relevant authorities and utility managers to minimize the adverse impacts.

74. **Preserving historic and/or cultural monuments**. Since the works are envisaged to be carried out within existing alignment, no impacts on historical and/or cultural monuments are expected. However, in the case of discovery during construction activities, the works shall be immediately stopped and the Ministry of Culture be informed. Works will proceed following discussion and guidance obtained from the Ministry of Culture or their respective subordinate or regional unit. A number of publicly erected memorials have been identified alongside the alignment. Where they interfere with the works they will be treated sympathetically and resited to a new location in consultation with the owners and local authorities.

75. **Public awareness**. To mitigate the disturbance to the population, appropriate information on the project (including location and duration of construction works) shall be regularly provided to affected communities. The local population should be appropriately informed about the commencement of construction works (information on proposed construction activities should be available on the website of the Ministry of Transport and

Communication, local authorities, and also through community newsletters, local TVs and from community leaders). Notification on commencement of construction works, limitation of vehicle movement, alternative access and detour arrangements shall be provided to affected communities in advance.

76. The project shall have an established grievance redress mechanism that will allow affected parties to raise their concerns and obtain feedback. Information on steps of grievance review and redress procedure as well as parties involved in grievance resolution shall be made publicly available and disclosed in affected communities.

f. Construction Phase Mitigation Measures

77. During the operation phase emphasis should be on better vehicle maintenance and emission checks to minimize negative environmental impact from traffic. The drainage system should be periodically maintained to ensure proper drainage to prevent flooding and damages caused by water in the road structure and frost heave.

78. **Waste management**. Waste containers will be placed at each recreation / park and rest area to collect waste disposed by road users. At recreation areas, where toilets are installed, the waste / sludge should be periodically removed to ensure good sanitary-hygienic conditions at the toilet facility. As a part of an operation and maintenance programme, agreement should be reached with appropriate authorities / entities to ensure timely regular collection transportation and disposal of waste to an approved disposal site.

79. **Maintenance of drainage system**. Proper maintenance of drainage system and other utilities must be carried out during operation of the road, including regular inspections and repairs as needed.

80. **Winter maintenance of roads**. Proper and timely winter maintenance of road will be carried out to avoid interruptions in road operation during the winter season. Chemicals for road de-icing shall be chosen carefully with due consideration of environmental impacts.

81. **Managing safety hazards**. Proper operation and maintenance of road and associated infrastructure will ensure risk is minimized. Roads signs, marking and safety elements (including guardrails, speed bumps, etc.) shall be regularly inspected and kept in appropriate working condition. Emergency preparedness and response procedures shall be implemented and enforced to ensure timely and adequate reaction in case of emergencies affecting road users (both vehicles and pedestrians) and the wider community.

F. Analysis of Alternatives

82. The ADB, Environmental Assessment Guidelines, 2003 state that alternatives to the project are to be considered and compared with the project in terms of their potential environmental impacts, capital and recurrent costs, suitability under local conditions and the institutional, training and monitoring requirements and that the economic values for alternatives should be estimated where possible.

83. The design consultant was directed to find a design that identifies the most needed interventions to improve road safety within an available budget of $ 100 million. To reach the target the Consultant adopted two basic criteria for the improvement of the M6 interstate road, which are to adapt the standards as match as possible to those provided by the Armenian Norms and to improve the safety for road users (reducing the problems of slopes instability), adopting the following actions:

- to take action only in the most problematic sections (from Vanadzor to Alaverdi), which represents the most critical part of the existing infrastructures, and consequently the most challenging part for the rehabilitation;
- to adopt the typical cross section of Category III.b, (two, 3.0m lanes with a 0.3m Shoulder stip – Total width 10.8m)[12] but with reduced shoulders;
- to limit the new pavement only where strictly necessary;
- to reduce as much as possible all other interventions (Rockall protections, Walls and River protection, avoid provision of Cut and Cover Tunnels), taking action only where strictly necessary;
- to reconstruct only the main damaged bridges;

84. Given the competing demands for space, by the crossborder railway link, river and road within the river valley that the existing alignment follows is no credible alternative alignment other than along the existing alignment through the Debed Canyon. The economic factors and the benefits from safety improvements support the Project but short of not implementing it, there is no alternative.

[12] EIB - Feasibility Study, Environmental Impact Assessment (EIA) and Detailed Engineering Design, Final Engineering Report (Oct 2015) Table 3

G. Information Disclosure, Consultation and Participation[13]

i. How information will be disclosed / disseminated

85. The main methods for stakeholder engagement, information dissemination include meetings, consultations, provision of information through the internet (particularly websites of the Contracting Authority and project Promoter - Ministry of Transport and Communication), through Marzpetaran and Local Governmental Bodies (LGB) responsible authorities, local NGOs (including Vanadzor and Alaverdi Aarhus Centres and their websites) and social networks, notification boards in the affected municipality's offices, distribution of leaflets and flyers, awareness through local mass media news announcements, newspapers, etc.

86. Public consultation/stakeholder meetings organized in project area (e.g. regional centers) in publicly accessible places and open for attendance by all stakeholders. The information about upcoming events should be disseminated at least 3 working days before the event date.

87. Some documents on the Project (tender advertisements, contracts, etc.) should be available through internet in the websites of the Contracting Authority and project Promoter, as well as on www.procurement.am.

88. As a promoter the Transport PIU should disclose project related reports (including ESIA, grievance redress mechanism, etc.). Information on project implementation (including environmental and social activities, grievance redress approaches) shall also be made available in project areas (e.g. offices of mayors' of villages/towns, upon request).

89. Details on stakeholder engagement and information dissemination are also provided in the Stakeholder Engagement Plan (SEP) is prepared for Feasibility Study, Environmental Impact Assessment and Detailed Engineering Design of the Rehabilitation and Improvement of M6 Vanadzor – Alaverdi – Georgian Border Interstate Road as a part of Environmental and Social Scoping Report.

ii. Public Consulation

90. The initial kick-off meeting for the "Technical assistance for the Feasibility Study, Environment Impact Assessment and Detailed Engineering Design of the Rehabilitation and Improvement of the M6 Vanadzor – Alaverdi – Georgian Border Interstate Road, Armenia" was carried out right after mobilization of consultant on March 4, 2014. The kick-off meeting was attended by key state stakeholders to be involved in management and implementation of current project. The purpose of the meeting was to present the Consultant and its team, explain the aim of the project, agree on the procedures to be followed to coordinate the further works. It was decided to have further consultations during scoping stage (according to the guidance from Transport PIU the follow up consultation, including participation of local stakeholders, will be carried out during the feasibility study phase after the alternatives of likely design solutions are discussed with the Client).

[13] This section sourced from the Final Engineering Report (Environmental and Social Impact Assessment (October 2015) pp 58-59

91. The public consultation to discuss design and environmental and social risks and issues related to the rehabilitation and improvement of M6 Vanadzor-Alaverdi-Georgian border interstate road took place on February 24, 2015. The public consultation was organized jointly by the RA Ministry of Transport and Communications and Lotti Ingegneria S.p.A. and was convened on February 24, 2015, at 11:30 in Lori Marz Administration. The representatives of Lotti Ingegneria S.p.A. and “Artsakhroad” Institute CJSC have presented in detail the works carried out within the framework of the Project of Rehabilitation and Improvement of M6 Vanadzor-Alaverdi- Georgian Border Interstate Road, as well as the works carried out for the purpose of revealing the possible issues and impacts in the process of preliminary environmental and social review. The participants of Public Consultation were given the information regarding the possible positive and negative environmental and social impacts connected with the implementation of the Project, as well as the measures envisaged for mitigating and minimizing the unfavorable environmental and social impacts. After the presentation the participants of the meeting were given the opportunity to express their opinion and ask questions. The participants of the public consultation signed in the registration list. The minutes of the meeting are included in Appendix C.

H. Grievance Redress Mechanism

i. Grievance Redress Mechanism

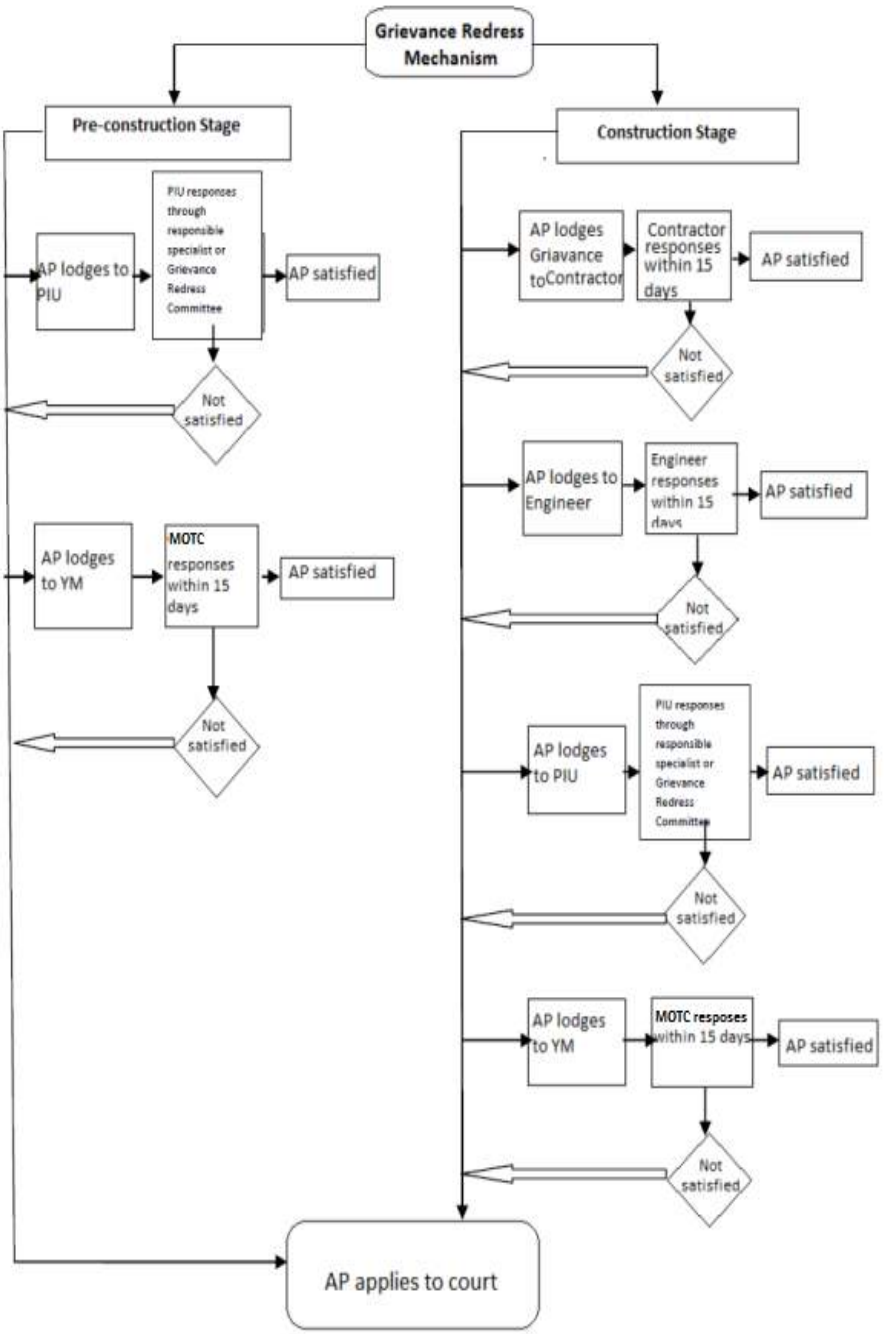
92. In order to receive and facilitate the resolution of affected peoples' concerns, complaints, and grievances about the project's environmental performance an Environmental Grievance Redress Mechanism is proposed for the project. When and where the need arises, this mechanism will be used for addressing any complaints that may arise during the implementation of project. The grievance mechanism is scaled to the risks and adverse impacts of the project. It addresses affected people's concerns and complaints promptly, using an understandable and transparent process that is gender responsive, culturally appropriate, and readily accessible to all segments of the affected people at no costs and without retribution. The mechanism is not impeding access to the Armenias judicial or administrative remedies. The project proponent will appropriately inform the affected people about the mechanism before start of commencement of any civil works.

ii. Grievance Focal Points, Complaints Reporting, Recording and Monitoring

93. The process for solving environmental complaints that may arise in the project is the Grievance Redress Mechanism, which will be established at each district in which the various project components will be implemented.

85. The procedural steps of the Grievance Redress Mechanism for the Project are provided below.

Figure 10 Grievance Redress Mechanism Flow-Chart



86. The following are the procedural steps to file a complaint, pose an inquiry on matters relating to project implementation, environmental concerns and other issues regarding the Project.

Pre-construction stage:

87. Step 1. The person affected by the Project could raise their suggestions/concerns/complaints first of all to the PIU. PIU receives and resolve/replies the APs' grievances.

88. If an AP is not satisfied with the response or PIU responsible staff needs additional capacity to response the APs' grievance, the Grievance Review Group (GRG) can be formulated to ensure comprehensive, equitable and transparent discussion of the case. To establish legitimacy of the GRG to review and judge on the substantive merit of the AP's complaint, the composition of the GRG should be balanced and include an independent observer to ensure the impartiality and transparency of the complaint review process. The following composition of the GRG is proposed:

Table 15 Propose composition of Grievance Review Group (GRG)

Members	Position
(a) Representative of PIU	Chairperson
(b) Representative of safeguards team (PIU)	Member
(c) Representative of Local Government, as relevant	Member
(d) Certified technical expert, as relevant	Member
(e) Representative of Engineer/Contractor, as relevant	Member
(f) Representative of the APs	Member
(g) Independent party (for example NGO)	Observer

89. To make for effective complaint processing, the role and responsibilities of each GRG member should be carefully elaborated and explained to them.

90. Step 2. If AP is not satisfied with PIU's decision even after GRG review of the grievance, then s/he can lodge the grievance to the RA Ministry of Transport and Comunication. MOTC follows Public Administration RA law for registration, revision and resolving the case.

Construction Stage:

91. **Step 1.** The person affected by the Project could raise their suggestions/concerns/complaints first of all to the Contractor's dedicated grievance staff that is an attempt will be made to resolve complaints at the local level. In order to maintain transparency and accountability to affected communities and to make information, assistance and grievance resolution services accessible to the Affected Persons, the Contractor will establish the following GRM as a part of the Project's integral GRM:

(i) AP's could approach Contractor's representative (construction foreman, engineer, social or environmental specialist) on-site and/ or register their suggestion /complain into the grievance register book kept by Contractor at the field office established in the construction camp located nearby the Row. The template for recording grievance, content and format of the application shall be specified in the Contractor's SEMP and agreed with Engineer.

(ii) Contractor ensures the provision of contact information (field office location, operating hours, names of responsible contact persons, phone numbers,

regular mail and email addresses, etc.) via posters and Project informational boards.

92. Contractor should immediately inform the Engineer and TPIU if AP lodged the grievance and should send the copy of written complaint to them. Contractor should implement appropriate mitigation measures to solve the issue and send the written response/reply to the AP with cc Engineer and TPIU.

93. Step 2. Should the AP be not satisfied with the Contractors' solution of his/her complain, the further opportunities are available. AP could next apply to the Engineer via lodging the complaint within one month after receiving/not receiving the response from the Contractor.

94. The incoming suggestions/ complains shall be considered and classified into environmental and social/resettlement items. The social/resettlement safeguard related complains shall be handled in the scope of Engineer and TPIU LARP specialists.

95. The environmental specialists of the Engineer in collaboration with the Contractor(s) shall establish an office at the Project site where environmental complaints of Projects' AP regarding EMP and project operations' impacts can be lodged. This Project site office will be used for: supervision of construction, including monitoring of the Contractor's compliance to the EMP to ensure the mitigation measures are timely and properly implemented; disclosing all safeguard documents; and receiving and responding to the comments/feedbacks from the community. The Engineer shall respond to the complaint within 15 days.

96. Step 3. Should the Engineer fail to satisfy the complaint, AP could apply to TPIU, MOTC, EA and ADB AM. The complaint in the Construction stage at the PIU level will be preceded with the same scheme as in the pre-construction stage. All the contact information shall be provided by Contractor on posters and on the Project informational board. Contractor shall serve as an entry point in this stage and provide the necessary explanations and assistance in application to the mentioned entities, if needed through the personal contact with AP.

97. Finally the AP can always seek attention and interference of the court. However all the efforts will be made to settle the issues at the Contractor's, the Engineer and TPIU level. If not possible, attempts will be made to resolve the issues at the MOTC level to avoid/minimize litigation as much as possible.

All complaints regardless of the outcome and solutions will be properly documented and made available for review, monitoring and evaluation purposes.

I. Environmental Management Plan

i. Environmental Management Plan

94. The EMP should be implemented in three stages: (i) before construction, (ii) during construction, and (iii) during operation and maintenance. EMP is a dynamic document and will be updated and adjusted in line with ongoing data collection, contractors' performance and monitoring results. The Implementing Agency will be responsible for introducing modifications to the EMP and include them in the report which will be submitted to ADB twice a year.

95. The tables at the end of this section present an Environmental Management Plan (EMP) that identifies feasible and cost-effective measures to be taken to reduce potentially significant adverse impacts to acceptable levels. The tables reflect the various stages of the project cycle: pre-design, design, construction and operations and maintenance. The last set of tables describe environmental monitoring activities at the pre-design, construction and operations stages.

96. This EMP is site-specific, and is focused on the rehabilitation and upgrading of the Project road. The Contractor will be responsible for preparing more comprehensive EMPs based on this EMP to match the Contractors working methods. These documents will be called Site Specific Environmental Management Plans (SSEMP). Before construction activities commence, the Contractor will prepare and submit proposals and method statements consistent with the EMP to the Implementing Agency for review and approval.

97. The EMP document draws on the site visits reported in the Alignment Sheets (Appendix 0) that delievered information on the areas of environmental concern. Specifically:

•

Table 16 Environmental Management Plan at the Pre-Design Stage

ENVIRONMENTAL ISSUE AND OBJECTIVE:	EMP: mitigation measures at pre-design stage		
Area	Potential impact	Mitigation measures	Responsibility
Protection of historical/cultural areas	• Identify potential historical / cultural sites that could be affected by onsite or offsite construction activity • Locate optional construction sites/activities away from them. • Ensure construction personnel are aware of locations of historical / cultural areas and avoid them • If the proposed construction passes close to historical / cultural areas, include temporary fences to restrict machines and activities from encroaching in the area.	The project road alignment has been the subject of a preliminary investigation. • There are two UNESCO World Heritage listed monasteries in the area (Haghpat and Sanahin) but they are remote from the alignment. • Around 50 small monuments and memorials have been located along the road (see Table 11_ of this document). These shall be relocated to new locations in accordance with the agreements with relatives and local authorities, as applicable. • The EMP for the construction phase includes provision for ceasing work and notifying the Engineer should artifacts of cultural or historical importance be unearthed.	Contractor to confirm and determine relocation strategy for small monuments assisted by the implementing agency. Costs included in the Contractors rates. Considered to include upto one day of consultation with "owner" and relocation (two labour and supervisor and small truck) for half day. Say 50 monuments @ $ 100 = $5000.
Protection of (sensitive) Natural areas	• Identify potential environmentally sensitive / natural areas • Locate optional construction sites/activities away from them. • Ensure construction personnel are aware of locations of sensitive areas and avoid them • If the proposed construction passes close to these areas, include temporary fences to restrict machines and activities from encroaching in the area.	The project road alignment has been the subject of a preliminary investigation See appendix 3 for report on trees bordering the alignment. • **Urban sections** in Vanazdor and Alaverdi pass through densely populated areas where natural ecosystems have been substantially altered by human habitation. • **Rural sections**, of the alignment assume that the upgrading works will not encroach beyond the existing road footprint. The existing road verges contain some opportunistic revegetation, whip trees, etc. No significant species have been noted or identified in preliminary investigations. • During the design phase attention should be paid to any impact on natural areas.	Tree survey information indicates that the majority of the trees subject to impact, within the alignment and requiring removal are immature whip trees. Less than 20 mature specimens (tree diameter 10cm) may need to be considered for cutting or trimming. It is assumed that replacement trees will be accommodated within the alignment footprint and will not require new land for replanting. Cost – to come
Environmentally Sound design To avoid erosion and damage to the road:	• Roads should have sufficient camber so that the rainwater flows away from the road.	A suitable camber should be included in the design, to ensure adequate flow of water from the road surface. Observations of natural drainage patterns during rainfall events suggest that, on reaching bare soil	

	• Road structures should have effective drainage systems (side-drains, culverts, etc.). • Cross drainage flows shall be addressed at bridges, culverts, etc.	surfaces, water will seep rapidly through the soil profile, except where the soil has been heavily compacted by vehicle movements. U drains should be provided in sections of the road where, due to the presence of walls or buildings, water cannot disperse naturally.	
Road Safety To avoid accidents during and after construction of the road:	• Occupational health and safety requirements are in place on construction sites in work camps. • Install lights and cautionary signs in hazardous areas. • Ensure that footpaths and pull-off bays along roads; through villages; and near markets, schools, and other community facilities are included in the design. • Include safety instructions for the construction activities in the contract documents. • If appropriate for traffic calming include speed bumps at sensitive locations. • Ensure sufficient visibility along the road section according to standard specifications.	Where the road passes through extended urban development (towns and villages) these shall be treated as speed control zones. In these zones, the following safety measures should be considered (i) ―village gatewaysǁ, which display the village name and speed limits (in English and Armenian) and have road markings to give the impression of constriction and encourage slower driving (ii) marked pedestrian walkways, (iii) speed humps (iv) raised kerbs, (v) marked bus bays and (vi) lighting. In all other areas, safety measures include footways wherever space permits, appropriate signage and trimming of vegetation where required to achieve adequate visibility. The EMP for construction provides for measures to ensure safety to workers and the public from construction activities.	
To minimize damage to personal and community property:	• Ensure works will be restricted to the right-of way of the existing road; • Ensure projected impacts and proposed measures have been discussed in advance with the affected community; • work with local government officers and non-governmental organizations. • Conduct surveys before activities commence to identify all members of affected populations.	Project impacts have discussed with communities and councils during the consultation process. Detailed surveys of affected property will be completed prior to construction	
EMP requirements included in the Design	• Preparation of SSEMP	TPIU will ensure that EMP will be adequately included in bidding documents and all environmental mitigation measures will be included in construction contracts. Monitoring of environmental quality and of the implementation of mitigation measures will be performed by the Construction Supervision Consultant (CSC) with sufficient TORs and staff-time for this task. As a minimum, it is required for CSC to recruit 3 months of an International Environmental Specialist and 12 months of	TPIU will be responsible for EMP implementation..

		a National Environmental specialist over 3 years during the project implementation. The monitoring results will be included in the project monthly and quarterly progress reports and semi-annual environmental monitoring reports	
Contrators SSEMP as an integral part of the bid documents	Contractor is responsible for the EMP implementation. The bidding documents shall have the Environment Protection section. EMP is a part of the bidding documents so that the bidder is aware of the environmental requirements for the Project.	The contractor will submit a site-specific Environmental Management Plan (SEMP) for the following, prior to commencing construction works, but not limited to: (i) SEMP for work in the main urban areas of Vanadzor and Alaverdi; (ii) Layout of the work camp with sewage management and waste management plan; (iii) Sitting and description of any asphalt and crushing plant, equipment maintenance and storage facilities; (iv) Spoil soil management plan; (v) Quarries and borrow site management including restoration (if developed under this contract, or clearly identified authorized and licensed facility); (vi) Method statement for bridge works; (v) method statement for blasting works. The SEMPs shall be guided and endorsed by the Construction Supervision Consultant for approval by TPIU.	Project proponent verifies that EMP is included into bidding documents

Table 17Environmental Management Plan at the Construction Stage

ENVIRONMENTAL ISSUE AND OBJECTIVE:	MITIGATION MEASURES	LOCATIONS	TIMEFRAME	COSTS	IMPLEMENTATION	SUPERVISION
Social or Community Concerns To minimize social disturbance and maximize community benefits from the project:	• Advise the local community of project plans in advance of construction, and involve them in planning, as necessary. • Avoid or minimize disturbances near living areas, schools, hospitals, etc. • Control runoff and manage sediments near cultivated areas • Abide by the laws of the Republic of Armenia relating to employment and use of labour. • Maintain liaison with community representatives and arrange for the involvement of community groups where practicable.	All locations	Throughout the project	Included in overall project cost. Assume 6 monthly meeting with major stakeholders (6 half day workshops) and meeting with stakeholders in major residential areas prior to works (half day workshop / briefing) say 10 half day workshops)	Contractor	CSC

	• Include women's and other community groups in project activities					
Removal of Vegetation and Land Clearing activities	• The road land width requiring clearing will be clearly demarcated on ground as per alignment plan • During land clearing operations, top soil will be collected, preserved, and reused as a base for turfing of embankment slopes or development of barren areas along road side. • Trees (generally opportunistic whips) falling within roadway width and other vegetative cover are to be removed. • Cultural properties (small monuments erected by the public) coming within the road land width, will be shifted to adjacent areas in consultation with local community leaders. • During clearing operations if any material is found that appears to have historical importance, work should stop and the authorities informed. • All public utilities like power transmission cables, telephone cables, water/sewerage lines, drains, tube wells etc. falling within road land width will be inventoried, and arrange for relocation /shifting to adjacent areas in consultation with the respective agencies/ authorities. • Establish and maintain interaction with local community to ensure that no social resentment sets in due to operations	All locations	Throughout the project	Included in overall project cost – More information to come following survey	Contractor	CSC
Establishment of temporary site office and material storage areas	• The contractors temporary offices and storage areas for construction works will be located away from human settlement areas (minimum 500 m) • The office and storage areas will preferably be located on barren/waste lands and conversion of agricultural/cultivable lands for	At identified location with prior approval of CSC	Throughout the Project	Contractor cost	Contractor with approval of CSC	CSC

	office and storage areas will not be allowed • All fuel oil/lubricants loading, unloading and storage areas will be paved (impermeable), and have separate storm water collection system with facility for separation of oil/lubricants prior to discharge. • The temporary office and storage area will be provided with adequate water supply, sanitation, septic tank/soak pit of adequate capacity so that it functions properly for the entire duration of its use. • After completion of construction works, the site will be restored to its previous state by undertaking clean up operations.					
Establishment of construction camp sites	• The construction campsites will be located away from any local human settlement areas and preferably located on lands, which are barren/waste lands. • The campsites will be provided with adequate water supply, sanitation and all requisite infrastructure facilities. This will minimize dependence on outside resources, presently being used by local populace and minimize undesirable social friction. • The camps will have septic tank/soak pit of adequate capacity so that it can function properly for the entire duration of its use. • Construction camps will be provided with kerosene/LPG to remove the practice of using firewood for cooking. • After completion of construction works, location of campsites will be restored to its previous state by undertaking clean-up operations	At identified camp location with prior approval of CSC	Throughout the Project	Contractor cost	Contractor with approval of CSC	CSC
Extraction and mobilization of construction materials i.e. boulders, aggregates, earth and water for construction	• Stone aggregates will be sourced only from licensed existing quarries. • No new crushers will be established and existing licensed crushers will be used.	At identified quarries and borrow area location with prior approval of CSC. It appears that	Throughout the project	Contractor cost	Contractor with approval of appropriate authority and CSC	CSC

	• Ensure stone quarries and crushing units have pollution control system, occupational safety procedures/practices in place and regular inspection will be carried to ensure compliance. This will be a pre-condition for sourcing of materials from quarries/crushing plants. • Any borrow areas identified in design report will be reassessed for its environmental sensitivity and ensure it is not an ecologically sensitive areas. Permits are to be obtained from authorities and all permit conditions are complied. • Borrow areas are to be demarcated with signboards and operational areas are to be access controlled. • Topsoil from borrow areas (first 30cm) are to be preserved and used for redevelopment of borrow areas • Conversion of agricultural lands for borrowing earth is to be discouraged to the use possible unless warranted by local conditions. In such cases, written consent will be obtained from the land owners. • Water for construction works will not be drawn from sources, which serve routine needs of local people.	the project will make use of existing, licensed, extraction sources. Needs to be confirmed by the contractor and proposals for other sources if required.				
Transportation of construction materials	• Existing tracks/roads are to be used for hauling of materials • Dust suppression by water tankers with sprinkling systems are to be deployed along haul routes. • The vehicles deployed for material transportation will be spill proof to avoid or minimize the spillage of the material during transportation. • Transportation links are to be inspected daily to clear accidental spillage, if any. • Precaution will be taken to avoid inconvenience to the local	Along haul roads with prior approval of CSC	Throughout the project	Contractor cost	Contractor with approval of CSC	CSC / RCD

	community due to movement of materials. • Dry materials to be covered to avoid dust blow. • Drivers to be educated on using appropriate speed limits when transporting material.					
Temporary traffic diversion	• Where required prepare appropriate traffic diversion plans (in specific stretches as per progress of construction work) and implemented to avoid inconvenience due to construction works to present road users. • Traffic diversion signs should be bold and clearly visible particularly at night. • Diversion schemes are required to ensure smooth traffic flow and minimize accidents to road users during construction works.	All along the project road	Throughout the project	Contractor cost	Contractor with approval of CSC	CSC
Construction of bridges / culverts	• Road construction will require re-construction of several bridges across streams/rivers • Refer to hydrological studies to ensure that re-construction method will not impede existing flows. • Schedule the construction works to dry season so that impacts on water quality of stream/river is minimized or avoided. • Caution to prevent oil/lubricant/ hydrocarbon spills from construction area into flowing to river. Edge bunds and all containers to be on drip / spill trays. Spillage, if any, will be immediately cleared with utmost caution to leave no traces.	Locations of bridges/culverts along the project road	During reconstruction	Contractor cost to include for pre works sampling and testing at the 6 major bridge crossings (See Table 12)	Contractor with approval of CSC	CSC
Tunnel reconstruction	• Use water to damp down dust generated during rock drilling, breaking or blasting • Warn local community 24hrs in advance of any rock blasting • Try to schedule blasting at the same time each day.	Locations of tunnels on the project road	During reconstruction	Contractor cost to include pre and pose construction air quality sampling and testing (see Table 13)	Contractor with approval of CSC	CSC

Cutting back slopes and fitting rockfall protection	• Use water to damp down dust generated during rock drilling, breaking or blasting • Warn local community 24hrs in advance of any rock blasting • Try to schedule blasting at the same time each day.	Locations of landslip protection along the project road	During reconstruction	Contractor cost	Contractor with approval of CSC	CSC
Establishment and operations of hot mix plants, laying of bitumen	• Hot mix plants will be established at least 500 m away from human settlements and preferably located on leeward side of most dominant wind direction. Notice to establish and operate are to be obtained from State Pollution Control Board and all permit conditions are to be implemented/ complied. • Hot mix plants will be set up on barren/waste lands, conversion of agricultural/cultivable lands for this purpose will not be allowed under any circumstances. • All operational areas like storage, handling, loading, unloading areas will be paved, and have separate storm water collection system with facility for separation of oil/lubricants prior to discharge. • The storm water from storage area will not be directly discharged into any, nearby water courses/drains. • The hot mix plants will be provided with adequate water supply, sanitation, septic tank/soak pit of adequate capacity so that it functions properly for the entire duration of its use. • After completion of construction works, the site will be restored to its previous state by undertaking clean up operations. • Hot mix plants will have required measures for control of dust, air, and noise pollution as per regulatory limits of State Pollution Control Board measures. • Appropriate traffic diversion schemes will be implemented when bitumen paving is under progress and all works will be planned and	Locations of hot mix plants along the project road	Throughout construction	Contractor cost	Contractor with approval of appropriate authority and CSC	CSC

	swiftly completed to avoid inconvenience to road users.					
Mobilization of construction machineries and vehicles	• All diesel powered equipment/vehicles/ deployed for construction activities will be regularly maintained for smooth operation, a measure contributing to air quality and noise. • Vehicles/equipment will be periodically subjected for emission tests and will have valid Pollution Under Control certificates. • All vehicles deployed for material movement will be spill proof to the maximum extent possible. In any case, all material movement routes will be inspected daily to identify and clear off any accidental spills.	All haul routes	Duration of the project	Contractor cost	Contractor with approval of CSC	CSC
Occupational Health and safety hazards at work and camp sites	• All personnel at work sites will be provided with protective gears like helmets, boots, etc. so that injuries to personnel are avoided or minimized. • Children and pregnant women will not be allowed to work under any circumstances. • No personnel will be allowed to work at site for more than 10 hours per day (8-hour makes one work shift). • Workforce, likely to be exposed to noise levels beyond regulatory stipulated limits, will be provided with protective gears like ear plugs etc and regularly rotated. • Dust suppression measures like sprinkling of water will be carried out at all operations areas. • The construction camps will have health care facilities for all workers. • All construction personnel will be subjected to routine vaccinations and other preventive/healthcare measures. • The work and campsites will have suitable facilities for handling any emergency situation like fire, explosion, etc.	All sites	Duration of the project	Contractor cost	Contractor with approval of CSC	CSC

	• All areas intended for storage of hazardous materials will be quarantined and provided with adequate facilities to combat emergency situations. All required permits for storage of inflammable/hazardous materials are to be obtained. • The personnel in charge of such areas will be properly trained, licensed and with sufficient experience. • The operational areas will be access controlled and entry will be allowed only under authorization.					
Cleaning work sites and waste disposal	• All operational areas (office/storage area, work force camps, and borrow areas) will be cleaned up and restored to its previous state soon after operations are complete. • All construction waste will be disposed in approved areas. Local district authorities will be consulted to determine disposal site and implement any conditions imposed while issuing permits.	All sites	Duration of the project	Contractor cost	Contractor with approval of CSC	CSC
Environmental monitoring and reporting to confirm compliance	• Safeguards Monitoring: Contractor's monthly reports and CSC's quarterly progress reports should have a section on safeguard compliance. TPIU will submit for disclosure at ADB and MOTC websites semi-annual environmental monitoring reports (EMR) in January and July each year. Final EMR will include post-construction environmental audit and will be submitted one month after the project physical completion	Project Reporting	Duration of the project	Included within management costs	Contractor, CSC	TPIU

Table 18 Environmental Management Plan at the Operation Stage

ENVIRONMENTAL ISSUE AND OBJECTIVE:	MITIGATION MEASURES	LOCATIONS	TIMEFRAME	COSTS	IMPLEMENTATION	SUPERVISION

Contamination from accidental spills	• The accident sites will be contained and cleared immediately. • Soiled earth will be removed, placed in a leak proof container and taken to a secure site for disposal. • Soiled earth removed will be replaced with clean inert material	All along the project road	Throughout project life	Maintenance cost	RCD	MoTC
Air Pollution	• Vehicular air pollution will be managed enforcing the vehicle emission rules. • Public awareness will be generated.	All along the project road	Throughout project life	Maintenance cost	TPIU	TPIU
Noise Pollution	• "No horn" signs for sensitive areas (schools, hospitals and religious structures) will be put up. • No Heavy vehicle "engine braking" allowed in urban areas • Public awareness program will be conducted.	All along the project road	Throughout project life	Maintenance cost	TPIU	TPIU
Water Pollution	• The drainage system will be cleaned periodically as per operation and maintenance manual. • Washing of vehicles by the roadside (particularly river crossings) will be prohibited and signs will be erected.	All along the project road	Throughout project life	Maintenance cost	TPIU	TPIU
Safety Measures	• A traffic management plan will be developed along congested locations. • Traffic control measures, including speed limits, will be enforced strictly.	All along the project road	Throughout project life	Maintenance cost	TPIU	TPIU

	• Encroachment and squatting within the ROW will not be accepted. • No schools or hospitals will be allowed to establish within the Right of Way.					

Table 19 Environmental Monitoring Plan

Environmental Features	Aspect Monitored	Time and Frequency of Monitoring	Location	Responsible party	
				Implementation	Supervision
Air Quality	P10, CO, NOx, SOx.	Before starting any construction activities, when requested during construction and once after construction	Urban environments in Vanadzor and Alaverdi and Thumanyan and four urban locations to be confirmed	Contractor	CSC/TPIU
Ambient Noise and vibration	$dB(A)_{leq}$	Before starting any construction activities, when requested during construction and once after construction	Urban environments in Vanadzor and Alaverdi and Thumanyan and four urban locations to be confirmed	Contractor	CSC/TPIU
Water Quality	SS, heavy metals	Before starting any construction activities at the key crossings (See Table 12), when requested during construction and once after construction	Key bridge crossings on the alignment	Contractor	CSC
Trees on alignment	Presence	Before starting any construction activities, during construction before any cutting and once after construction	Full length of alignment, but primarily in non-urban section	Contractor	CSC

J. Conclusion and Recommendation

98. This Initial Environmental Examination (IEE) has been prepared for the M6 Vanadzor-Alaverdi-Georgian Border Interstate Road Rehabilitation and Improvement Project. This IEE has examined the implementation of the rehabilitation and improvement of M6 Vanadzor-Alaverdi-Georgian border interstate road. The IEE envisages that all the potential adverse and beneficial social and environmental impacts of the proposed final design option will be prevented and/or mitigated and the positive impacts strengthened in the result of implementation of mitigation and enhancement measures identified in the Environmental Management Plan.

99. The positive socio-economic and environmental effects of the project outweigh the likely environmental and social risks associated with its implementation. Implementation of the project will improve efficiency of transportation; provide reliable, speedy and safe commute and connection; decrease operation and maintenance costs for road infrastructure; significantly reduce risk of accidents; reduce vehicle maintenance costs for both commuters and cargo transporters; contribute to improved social and economic welfare of the local population, both men and women.

i. Conclusions

100. This Initial Environmental Examination (IEE) covers the upgrading and operation of a 90Km road between the northern city of Vanadzor in Armenia and the border with Georgia close to Bagratashen.

101. Based on site inspections it has been concluded that project components do not encroach upon ecologically sensitive areas. They are located either within the boundaries / footprint of the existing road corridor. Decisions are still needed on the location of worksites to house the work force, construction equipment and materials but there are suitable sites available along the alignment where camps could be established that would not adversely impact on existing sensitive receivers.

102. Potential environmental impacts were identified in relation to design, location, construction and operation of the improved infrastructure and mitigation measures have been developed to reduce all negative impacts to acceptable levels.

103. Overall the proposed project is unlikely to cause any adverse environmental impacts. This is due to the following findings:

- All of the alignment will be rehabilitated within the footprint of the existing road.
- There are no sites of cultural or heritage significance within the area of influence of the alignment.
- There are no ecologically sensitive sites or protected areas falling within the alignment or its zone of influence
- The road realignments will remove tight bends, overstep hills sections and improve sight lines making vehicle movements more efficient.
- The road improvements will include incorporation or upgrading of safety equipment along the alignment
- Where appropriate slopes will be cut back to more stable angles and incorporate rockfall protection improving driver safety.

- Construction and operation of the project is likely to give rise to nil, negligible or at worst, minor temporary environmental impacts that can be easily mitigated to acceptable levels.

104. An Environmental Management Plan (EMP) has been prepared for the project. The EMPs are included as part of this IEE and include (i) mitigation measures for potential environmental impacts during implementation, (ii) environmental monitoring program, and (iii) the responsible entities for mitigation, monitoring, and reporting.

105. Mitigation will be assured by a program of environmental monitoring to be conducted during the construction stages. The environmental monitoring program will ensure that all mitigation measures proposed in the EMPs are implemented, and will determine whether the environment is protected as intended. Any requirements for remedial action will be reported to the ADB.

106. Project stakeholders were consulted during preparation of the IEE and invited to express any environmental and social concerns they had regarding the project. No significant environmental and social concerns were raised and all stakeholders consulted strongly support the project and are looking forward to the benefits of the improved road corridor. The IEE will be made available at public locations and will be disclosed to a wider audience via the ADB website. The consultation process will be continued during project implementation to ensure that stakeholders are fully engaged in the project and have the opportunity to participate in its development and implementation

107. Environmental and social benefits of the investment components and long-term project objectives far outweigh the minor and temporary inconveniences that will arise during project implementation. Provided the EMPs are properly implemented there will be no unacceptable impacts arising from the project.

108. This IEE including EMP are considered sufficient to meet the environmental assessment requirements of ADB and Government of Armenia. Therefore, a full environmental impact assessment study is not required.

Appendix 1- Rapid Environmental Assessment (REA) checklist

Rapid Environmental Assessment (REA) Checklist

Instructions:

(i) The project team completes this checklist to support the environmental classification of a project. It is to be attached to the environmental categorization form and submitted to the Environment and Safeguards Division (RSES), for endorsement by Director, RSES and for approval by the Chief Compliance Officer.

(ii) This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB's (a) checklists on involuntary resettlement and Indigenous Peoples; (b) poverty reduction handbook; (c) staff guide to consultation and participation; and (d) gender checklists.

(iii) Answer the questions assuming the "without mitigation" case. The purpose is to identify potential impacts. Use the "remarks" section to discuss any anticipated mitigation measures.

Country/Project Title:	Armenia / **M6 Vanadzor-Alaverdi-Georgian Border Interstate Road Rehabilitation and Improvement Project**
Sector Division:	CWTC

Screening Questions	Yes	No	Remarks
A. Project Siting Is the project area adjacent to or within any of the following environmentally sensitive areas?			
▪ Cultural heritage site	☐	☒	There are two UNESCO World Heritage listed monasteries in the area (Haghpat and Sanahin) but they are remote from the alignment. There are a number of small memorials erected by the public adjacent to the alignment. These will need to be sympathetically relocated if they interfere with the works.
▪ Protected Area	☐	☒	Non identified. All remote from alignment.
▪ Wetland	☐	☒	Alignment runs adjacent to and crosses Pambak and Debed rivers, But no extended areas of bog, march, swamp identified impacted by the alignment.
▪ Mangrove	☐	☒	N/a
▪ Estuarine	☐	☒	N/a
▪ Buffer zone of protected area	☐	☒	N/a
▪ Special area for protecting biodiversity	☐	☒	Non identified
B. Potential Environmental Impacts Will the Project cause…			
▪ encroachment on historical/cultural areas; disfiguration of landscape by road embankments, cuts, fills, and quarries?	☐	☒	Road verges contain opportunistic revegetation, whip trees, etc. No significant species noted.
▪ encroachment on precious ecology (e.g. sensitive or protected areas)?	☐	☒	Road verges contain opportunistic revegetation, whip trees, etc. No significant species noted.

Screening Questions	Yes	No	Remarks
▪ alteration of surface water hydrology of waterways crossed by roads, resulting in increased sediment in streams affected by increased soil erosion at construction site?	☐	☒	Any new bridges will span rivers, no in-stream piers.
▪ deterioration of surface water quality due to silt runoff and sanitary wastes from worker-based camps and chemicals used in construction?	☒	☐	Potential for impact if camps are not adequately managed.
▪ increased local air pollution due to rock crushing, cutting and filling works, and chemicals from asphalt processing?	☒	☐	(i) Cutting back of unstable slopes will require rock breaking and drilling to fix rockfall protection elements. (ii) Removal of existing running surface (milling) has potential to generate dust. (iii) Reconstruction of second tunnel will require rock drilling and rock breaking with potential dust impacts but this section is remote from sensitive receivers. (iv) Urban sections will have works close to residential development with potential for adverse impact. (v) Operation of rock crushing and asphalt plan has potential for localized dust impact.
▪ risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during project construction and operation during project construction and operation?	☒	☐	(i) During construction potential for adverse impact due to the construction process (air / noise) on workers and any adjacent sensitive receivers. (ii) During operation potential impact from road operations with increased traffic volume and speed, though it is noted that the improvement of the running surface and vertical and horizontal alignment will assist in reducing emissions and reduce potential for road traffic accidents.
▪ noise and vibration due to blasting and other civil works?	☒	☐	(i) Reconstruction of second tunnel will require rock drilling, but this site is remote from any sensitive receivers. (ii) Cutting back of existing steep rock faces and installing slope protection features has potential for adverse impact but these areas are remote from sensitive uses. (iii) No blasting is anticipated in urban areas. (iv) Civil works will generate impacts to the residential and commercial areas but the impacts will be minimized through EMP
▪ dislocation or involuntary resettlement of people?	☐	☒	No dislocation or involuntary resettlement envisaged.
▪ dislocation and compulsory resettlement of people living in right-of-way?	☐	☒	No change from existing situation
▪ disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?	☐	☒	No impact anticipated

Screening Questions	Yes	No	Remarks
▪ other social concerns relating to inconveniences in living conditions in the project areas that may trigger cases of upper respiratory problems and stress?	☐	☒	None identified
▪ hazardous driving conditions where construction interferes with pre-existing roads?	☒	☐	Short term impacts during construction. In urban areas where there is residential and commercial activity, access to property and businesses needs to be maintained to avoid conflict.
▪ poor sanitation and solid waste disposal in construction camps and work sites, and possible transmission of communicable diseases (such as STI's and HIV/AIDS) from workers to local populations?	☒	☐	Potential for impact if camps are not adequately managed and worker education initiated.
▪ creation of temporary breeding habitats for diseases such as those transmitted by mosquitoes and rodents?	☐	☒	Historic issue. Armenia attained malaria free status in 2011[1]. Addressed in Site Management Plan.
▪ accident risks associated with increased vehicular traffic, leading to accidental spills of toxic materials?	☐	☒	Horizontal and vertical realignment will remove hazardous driving features i.e. poor sight lines, tight bends, overstep sections.
▪ increased noise and air pollution resulting from traffic volume?	☒	☐	(i) During construction there will be increased vehicle movements due to construction traffic. (ii) During operation - Current running surface is uneven, increasing noise impact from rattling trailers. Improved horizontal and vertical alignmnets will improve effort on vehicle engines i.e. reduce breaking and accelerating operations.
▪ increased risk of water pollution from oil, grease and fuel spills, and other materials from vehicles using the road?	☒	☐	(i) During construction potential for adverse impact from construction operations i.e. spills. (ii) During operation, Improved horizontal and vertical alignments should reduce risk of accidents / spills
▪ social conflicts if workers from other regions or countries are hired?	☒	☐	Industrialized towns along the alignment have suffered from high unemployment since the collapse of the Soviet Union. Opportunity for local employment, commercial opportunity can stimulate local economy and ease tensions.
▪ large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?	☒	☐	Construction camps and working sites on the alignment to be self-contained in terms of provision of water and disposal of solid and liquid wastes
▪ risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during construction and operation?	☒	☐	Potential for adverse impact during construction due to storage, transport and use of construction materials. Mitigation through good site management.

[1] http://www.euro.who.int/en/health-topics/communicable-diseases/vector-borne-and-parasitic-diseases/malaria/country-work/armenia

Screening Questions	Yes	No	Remarks
▪ community safety risks due to both accidental and natural causes, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning.	☒	☐	(i) During construction contractor to ensure that sites are secure and communities are separated from construction activity. Particularly in urban areas. Most of the alignment is remote from communities. (ii) During operation the design will improve local community road safety by incorporation of appropriate street furniture i.e. signage, central reserves, verges.

A Checklist for Preliminary Climate Risk Screening

Country/Project Title: Armenia / TA-8926 ARM: M6 Vanadzor-Alaverdi-Georgian Border Interstate Road Rehabilitation and Improvement Project

Sector :

Subsector:

Division/Department:

Screening Questions		Score	Remarks[2]
Location and Design of project	Is siting and/or routing of the project (or its components) likely to be affected by climate conditions including extreme weather related events such as floods, droughts, storms, landslides?	0	Alignment has been subject to landslides and rockfall in the past. The proposed design specifically includes provision for regrading of slopes and rockfall protection.
	Would the project design (e.g. the clearance for bridges) need to consider any hydro-meteorological parameters (e.g., sea-level, peak river flow, reliable water level, peak wind speed etc)?	0	-
Materials and Maintenance	Would weather, current and likely future climate conditions (e.g. prevailing humidity level, temperature contrast between hot summer days and cold winter days, exposure to wind and humidity hydro-meteorological parameters likely affect the selection of project inputs over the life of project outputs (e.g. construction material)?	0	-
	Would weather, current and likely future climate conditions, and related extreme events likely affect the maintenance (scheduling and cost) of project output(s) ?	0	Alignment has been subject to landslides and rockfall in the past. The proposed design specifically includes provision for regrading of slopes and rockfall protection.
Performance of project outputs	Would weather/climate conditions, and related extreme events likely affect the performance (e.g. annual power production) of project output(s) (e.g. hydro-power generation facilities) throughout their design life time?	0	-

Options for answers and corresponding score are provided below:

Response	Score
Not Likely	0
Likely	1
Very Likely	2

Responses when added that provide a score of 0 will be considered low risk project. If adding all responses will result to a score of 1-4 and that no score of 2 was given to any single response, the project will be assigned a medium risk category. A total score of 5 or more (which include providing a score of 1 in all responses) or a 2 in any single response, will be categorized as high risk project.

Result of Initial Screening (Low, Medium, High): Low

Other Comments: Nil

Prepared by: _____

[2] If possible, provide details on the sensitivity of project components to climate conditions, such as how climate parameters are considered in design standards for infrastructure components, how changes in key climate parameters and sea level might affect the siting/routing of project, the selection of construction material and/or scheduling, performances and/or the maintenance cost/scheduling of project outputs.

Appendix 2 - Alignment Sheets (Photos)

IV. ALIGNMENT SHEETS

The following alignment sheet provides an overview of environmentally sensitive hotspots and receptors alongside the 90Km M6 Project road running from Vanadzor to the Georgian Border. Photos are referenced to Project chainage. The alignment sheets serve as a base for impact analysis.

No.	Location	Km	Picture	Issue
The project is divided into two funding Lots: Lot 1 – European Investment Bank Vanadzor (Km0) to Tumanian (Km 36) Lot 2- Asian Development Bank Tumanian (Km 36) to Border (Km90)				
Section 1: Urban Vanadzor - along the Baghramyan Avenue (0 to 6.5Km).				
1.1	Start of the M6 project road at Vanadzor	0		Looking west – away from the alignment. Potentially sensitive residential blocks are remote from alignment on RHS of photo.
1.2	Baghramyan Avenue	0		Looking east along the alignment. Area is light industrial no sensitive receptors.

No.	Location	Km	Picture	Issue
1.3		1		Commercial urban development. Some residential property (apartments) adjacent to alignment. Potential construction noise and dust issues. Discharges of silty water to existing drains
1.4		2		Apartment blocks set back and elevated from the alignment. Some noise / visual screening by retaining wall.
1.5		2		No sensitive development in this section
1.6		3		Apartment blocks adjacent to the alignment. Commercial property at ground level. Potential construction noise and dust and silty runoff during construction.

No.	Location	Km	Picture	Issue
1.7		3		Apartment blocks adjacent to the alignment (LHS). Commercial property at ground level. Commercial low rise RHS. Potential construction noise and dust and silty runoff during construction.
1.8		3		Apartment blocks adjacent to the alignment. Some opportunistic trees established on fringes of alignment. Potential construction noise and dust and silty runoff during construction. Loss of trees.
1.9		4		Light industrial (car repair workshops)

No.	Location	Km	Picture	Issue
1.10		5		Cemetery on the LHS of the alignment. The road will not encroach into the cemetery. Silty runoff during construction.
1.11		5		
1.12		5		Light industry on LHS
1.13		6		Abandoned industrial site (RHS). Site has been levelled of former concrete framed buildings.
1.14		6		Road passing under bridge. Careful construction work and proper disposal to avoid blocking of

No.	Location	Km	Picture	Issue
1.15		6.5		Operating crushing plant (RHS). Dust suppression equipment installed but not operating on all components. Crushing plant can gerate adverse noise, dust and water quality (silty runoff).
1.16		6.5		Operating asphalt plant (RHS), adjacent to crushing plant. Asphalt plant can gerate noise, air quality (dust and odour) and water quality impact (silty runoff and hydrocarbon spills).
Section 2: Sub urban section Vanadzor to Alaverdi (6.5Km to 50.8Km) EIB upto Tumanian (Km 36) and ADB from Tumanian				
2.1		7		Typical scene. No sensitive uses adjacent to the alignment.

No.	Location	Km	Picture	Issue
2.2		9 to 13		Slope stabilisation needed. SEMP required to avoid waste and spoil dumping to river on RHS. Potential water quality impact from silty runoff and loss of habitat (trees).
2.3		14 to 22		Retaining wall will be constructed due to the road widening. River bank protection is required. Tree cutting needs to be estimated. Potential water quality impact from silty runoff and loss of habitat (trees).
2.4		24		Electricity sub station. Note electrified railway line to the Georgian border in elevated position centre of photo.

No.	Location	Km	Picture	Issue
2.5				Isolated commercial property (RHS). The pipes on the LHS of the road are gas distribution pipework, they will need relocation.
2.6				Isolated dwelling (RHS). Note electrified railway line to the Georgian border in elevated position. Potential construction noise and dust impact.
2.7				Isolated dwellings (LHS). Alignment will not encroach into exising boundary. Potential construction noise and dust impact.

No.	Location	Km	Picture	Issue
2.8	Leaving Vahagn adzor			Steep crumbling slopes on LHS of road. Rockfall on road edge. Potential noise impact (drilling and blasting or breaking), air quality (dust) and silty runoff).
2.9		24 +485		Railway crossing over alignment. Some modification of horizontal alignment to improve sightlines and reduce curvature
2.10		24 +866		Tunnel 1, south portal. 105m long. Tunnel is lined but floor is uneven and there is no lighting. Some renovation planned. Potential noise impact (drilling and blasting or breaking), air quality (dust from ventilation equipment) and silty runoff).

No.	Location	Km	Picture	Issue
2.11				Steep slopes with rockfall. Regrading and rockfall protection to be installed Potential noise impact (drilling and blasting or breaking), air quality (dust) and silty runoff).
2.10				Steep slopes with rockfall. Regrading and rockfall protection to be installed. Potential noise impact (drilling and blasting or breaking), air quality (dust) and silty runoff).
		27 to 28		Slope stabilisation – Blasting Site. Road is narrow and Kambak river is adjacent. No alternative route is available SEMP is needed. Potential noise impact (drilling and blasting or

No.	Location	Km	Picture	Issue
				breaking), air quality (dust) and silty runoff).
2.11				Steep slopes with rockfall on LHS. Potential noise impact (drilling and blasting or breaking), air quality (dust) and silty runoff).
2.12		30 +579		Tunnel 2 South portal. 270m long. Tunnel will be rebuilt using drill and blast or pneumatic hammer within tunnel shield. Potential noise impact (drilling and blasting or breaking), air quality (dust from extract fans) and silty runoff.

No.	Location	Km	Picture	Issue
2.13		30 +579		Unlined and unlit tunnel, very rough running surface
2.14		31 +287		Tunnel 3 South portal. 171m long. Tunnel is lined but floor is uneven and there is no lighting. Some renovation planned. Potential noise impact (drilling and blasting or breaking), air quality (dust) and silty runoff).
2.15a		31 +647		Bridge 9 (Km 31+647) in very poor condition. Accident black spot. Bridge to be replaced on left of existing Debed River is a main

No.	Location	Km	Picture	Issue
2.15b				waterway in the region. Baseline monitoring is required on water quality, hydrological and aquatic resources. SEMP needed. Potential water quality impacts from silty runoff and hydrocarbon or chemical spills.
2.16				Industrial building on LHS of alignment
2.17				
2.18		33 +140		Rail bridge crossing the alignment

No.	Location	Km	Picture	Issue
2.19				Steep slope on RHS with rockfall. Regrading and rockfall protection to be installed. Potential noise impact (drilling and blasting or breaking), air quality (dust) and silty runoff).
2.20				Steep slope on RHS with rockfall. Regrading and rockfall protection to be installed. Potential noise impact (drilling and blasting or breaking), air quality (dust) and silty runoff). Loss of habitat (trees)
2.21				Steep slope on RHS with rockfall. Regrading and rockfall protection to be installed. Potential noise impact (drilling and blasting or breaking), air quality (dust) and silty runoff). Loss of habitat (trees).

No.	Location	Km	Picture	Issue
2.22	Entering Tumanian	35.5		Township has abandoned industrial plant and residential
2.24		35 +943		Bridge to be refurbished. Potential noise impact (breaking), air quality (dust) and silty runoff, hydrocarbon or chemical spills to river).
2.23	Leaving Tumanian	36		Potential construction noise impact (breaking and milling), air quality (dust during milling) and silty runoff.
End of EIB section / Start of ADB Section				

No.	Location	Km	Picture	Issue
2.25		39 +760		New bridge and re-alignment over railway. Major earthworks and tree cutting. Estimate and SEMP required. Potential noise impact (breaking), air quality (dust) and silty runoff, hydrocarbon or chemical spills to river).Loss of habitat (trees).
2.26				Typical streetscape on approach to Alarverdi
2.27				Typical streetscape on approach to Alarverdi

No.	Location	Km	Picture	Issue
	Sanahin by railway station	47 +925		New bridge and realignment in Sanahin. The new alignment is on the foot of a hill where residential property is located. Baseline monitoring . SEMP to minimise risk of cracking, slide, traffic impact. Potential noise impact (breaking), air quality (dust) and silty runoff, hydrocarbon or chemical spills to river).
Section 3: Km50.8 to 54Km – Urban Alverdi				
3.1	Urban Alverdi			Residential development adjacent to alignment passing through Alaverd. Constrcution noise impacts and dust impact. Also silty runoff to existing road
3.2	Urban Alverdi			

No.	Location	Km	Picture	Issue
3.3	Urban Alverdi			drainage system.
3.4				Isolated commercial development beyond Alaverdi
3.4	Alaverdi			Alaverdi. Operating copper processing plant
Section 4: Km 54 to Km90 – Lower reaches of valley system and plain – Sub urban				
4.1				Typical roadscape beyond Alaverdi upto the border. Potential noise and dust impact on isolated sensitive (residential) uses and silty runoff or hydrocarbon spills.
4.2				
End				

Appendix 3 - Plant species Along the M6 Vanadzor – Alaverdi – Georgian Border Interstate Road

Appendix 3 - Plant species Along the M6 Vanadzor – Alaverdi – Georgian Border Interstate Road

Program of M6 "Vanadzor-Alaverdi-Georgian border" interstate highway rehabilitation and improvement

M6 "Vanadzor-Alaverdi-Georgian border" interstate highway (Fig. 1) is a strategic and had vitally important corridor to Armenia imports and exports, and also for local transportation. It connects Armenia to the Georgian Black Sea ports, the CIS, Europe and other countries.

M6 interstate highway goes along the canyon Debed and Pambak rivers, and is limited by two main elements: riverbeds and railway line to Georgia. The latter runs alongside the road at several sections (at several sections crossing it).

Fig. 1. On the aerial photograph of Google Earth is shown the common corridor of road project in red (a photo taken from official site of Ministry of Transport and Energy)

The existing carriageway of interstate highway has bilateral asphalted way and gravel shoulders. Carriageway width does not meet interstate highway standards. Road pavement is in bad condition, especially there are deformations, many lacy and transverse cracks, holes and insufficient feasibility of infrastructure. Existing road is very sinuous; curvature radii often do not meet minimum standards of interstate highway.

There are 40 bridges (13 of which are 10 meters or more in length) and 3 short tunnels along the road.

In February 2016, along "Vanadzor-Alaverdi-Georgian border" interstate highway we have fulfilled floristic survey, collection of some tree species for herbarium, trees and shrubs photos for exploration of the area vegetation current state of flora.

For the data analysis were used quantitative analysis methods of flora by L.I. Malisheva (1975).

Source for determination of species has served Flora of Armenia (11 volumes, 1954-2009), Plants Red Book of Armenia (2010) and etc. Scientific plant names have been corrected according to methodical manual by S. Tcherepanov (Tcherepanov, 1995) and etc.

Geographic coordinates recorded by the Garmin-2 GPS device.

The studied area belongs to Ijevan floristic region (Caucasian subprovince, Tsirkumboreal province, Boreal Floral subkingdom, Holarctic kingdom) (Takhtajan, 1978). The vegetation of investigated sections has expressed mezo-xerophilous and mesophilic character, is specific steppes, forests, also riparian forest (*Fig. 8, 9, 11-14, 1, 19, 21*). In some places of territory expressed scrub and rocky vegetation. Background plants are relatively rare, the flora is mainly woody. In the upper parts of the study area expressed in common hornbeam (Fig. 6, 7) forests and oriental hornbeam forests, Jerusalem thorn bushes in the lower parts (*Fig. 10, 16, 18*) In roadsides mostly developed secondary vegetation (Fig. *3, 17, 19, 21*).

The total length of M6 "Vanadzor-Alaverdi-Georgian border" interstate highway is about 91 km. It is divided into 4 separate sections, each of which has its own characteristics.

SECTIONS 1.

- **Vanadzor (0 – 6.5 km)** (Fig. 2),
- **Alaverdi (50,8 – 54,0 km**)

- *Roadworks:* urban areas, which is not designed to carry road realignment. At these sectors are expected to perform replacement of existing carriageway swept, traffic and pedestrian safety improvements, improvement of drainage system, crossings and circumvention design. It is intended to improve pavement and provide security elements.
- *Botanical part.* The beginning of the interstate highway M6 (0 km) is located in the Vanadzor city. In urban areas there are trees about 15-20 sm diameter near roadsides, but which do not hinder traffic, only need regular pruning of branches. mostly grow poplars, ash, maple trees.

Fig. 2. City Vanadzor, 0

SECTIONS 2.

- **Vanadzor -Alaverdi sector (6,5 – 50,8 km)**

- *Roadworks:* It is planned to build a new dam along the road and extension of the carriageway for the safe operation of the infrastructure. For existing 3 tunnels will redesign lateral incision according to norms, lining, pavement reconstruction, also providing illumination and security measures. In this section will be implemented reconstruction of 3 damaged bridges and repair of others.

• *Botanical part.* After city Vanadzor, from 6-7 km to village Vahagnadzor tree stumps are basically out of the way, but the branches are located in the traffic lane. It is necessary to cut a False acacia tree (up to 10 cm in diameter) (Fig. 3) and carry out pruning work of sea buckthorn bushes (Fig. 5).

Fig. 3. Outside city Vanadzor, 7 km, False acacia (Robinia pseudoacacia)

Fig. 4. 8-10 km, pine plantations

Fig. 5. 8-10 km, sea buckthorn bushes

In this section, there is a fragment of very sharp band on 18-19 km, which is dangerous for loaded vehicles, especially when there is snow and ice.: There are growing Acer platanoides, Carpinus betulus, Salix caprea, Ulmus leavis, Prunus divaricata, Fraxinus excelsior and other trees. These trees are of medium size, 5-15 cm in diameter, 2-3 examples of each species (Fig. 6, 7):

Fig. 6. Up to Vahagnadzor, turning point

Fig. 7. Turning point, Carpinus betulus

Village Vahagnadzor: there is a bridge after 30-40 m of village nameplate, which must be expended, improved. There is growing *Salix alba*, which should partly be cut down (sanitary pruning), tree is wrapped in branches of liana Humulus lupulus, pruning should be done carefully (Fig.. 8, 9). There are rockfalls outside the village.

Նկ. 8. V. Vahagnadzor, after 30-40 m of nameplate

Fig. 9. V. Vahafgnadzor, *Salix alba*

Village Vahagni: rockfalls outside the village. The trees (about 10 cm in diameter) growing around them must be cut for conducting network of rockfall protection. These trees are not registered in Red Data Book of Armenia and do not have other special status.

Fig. 10. Rockfall outside of village Vahagni

After 3rd tunnel bridge (up to village Tumanyan). This place is the intersection of Dzoraget and Pambak rivers, from where begins river Debet. Here, especially on riversides, there are trees over 10-20 cm in diameter (Salix excelsior, S. alba, Prunus spinosa, Robinia pseudoacacia, Celtis caucasica, Ulmus minor, Sambucus nigra, Acer negundo, Ailanthus altissima, Cornus mas, Corylus avellana) (Fig. 12-15). It is impossible to avoid cutting them for reconstruction works of bridge and tunnel. It should be noted that they do not have a special status.

Fig. 11. 3-rd tunnel

Fig. 12. The bridge after 3-rd tunnel

Fig. 13. Intersection of Dzoraget, Pambak and Debet rivers

Fig. 14. Trees on riversides

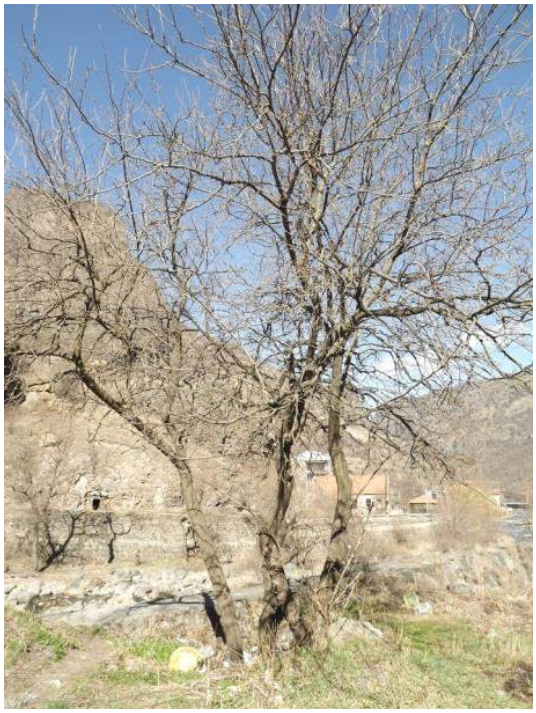


Fig. 15. After 3-rd tunnel, Celtis caucasica

Outside of v. Tumanyan (also almost the entire length of the highway) there are bushes, which necessary to clean (Robinia pseudoacacia, Rubus anatolicus, Rubus idaeus, Cornus mas, Ailanthus altissima)(Fig. 16, 17, 18).

Fig. 16. Outside of v. Tumanyan, Ailanthus altissima

Fig. 17. Outside of v. Tumanyan, Cornus mas

Fig. 18. Outside of v. Tumanyan

SECTIONS 3.

- **From Alaverdi (54 km) to Qarkop (77 km)**

• *Roadworks:* Road dam reconstruction and some small changes in alignment. Improvement of Drainage system, retaining walls, communications,safety measures.

Fig. 19. Vicinity of village Qarkop

• *Botanical part.* Sanahin-Noemberyan crossroad, planned to build a new bridge. No woody vegetation on construction sector. On the remaining parts need to be removed bushes and low-cost (young) trees (Ulmus minor, Robinia pseudoacacia, Paliurus spina-christi and etc.).

SECTIONS 4.

- **From Qarkop (77 km) to bagratashen-Georgian border sector (91 km)**

• *Roadworks*: Planned to implement only road dam reconstruction and to provide security elements.

• *Botanical part.* Woody forms are rarely and in small sizes (Paliurus spina-christi, Berberis vulgaris, Hedera helix and etc.). It is necessary to carry out the bushes, shrubs, cleaning works.

Fig. 20. Vicinity of Ayrum, Rubus sp.

Fig. 21. Vicinity of Ayrum

Conclusion

Along the M6 “Vanadzor-Alaverdi-Georgian border” interstate highway should be implemented complete cleaning of bushes of road shoulder, water lines.

Plant pruning, cutting, bushes cleaning works will be carried out between carriageway and pillars of security and road elements, where the trees are up to 10 cm in diameter and meeting rarely.

Along all M6 highway have not revealed plants registered on Red Book of Armenia, or having rare, endemic, reduced distribution, endangered or other special status.

List of M6 roadside vegetation (in Latin, Armenian and English), is given a separate Excel file. Also mentions the living style of species.

Studied plant species belong to 48 species, 31 genera and 21 families.

This work consists of 10 pages, 21 figures and 12 links of literature.

Literature

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TAXA - Armenian name	TAXA - English name	lifestyle	Vanadzor town (0 – 6.5 km)	Alaverdi town (50.8 – 54,0 km)	Vanadzor to Alaverdi (6,5 – 50,8 km)	Alaverdi (54 km) to Qarkop (77 km)	Qarkop (77 km) to Bagratashen-Georgian border (91 km)
ԱՍԵՐՄԵՐ							
Թխկի դաշտային	Field maple	Tree			ok	ok	
Թխկի հացենիատերև	Boxelder maple, Ash-leaved maple	Tree	ok	ok	ok		
Թխկի սրատերև	Norway maple	Tree			ok	ok	
Բաղեղ կովկասյան	Ivy	Liana	ok		ok	ok	ok
Կծոխուր սովորական	European barberry	Shrub				ok	ok
Բոխի սովորական	Common hornbeam, European hornbeam	Tree			ok		
Բոխի արևելյան	Common hornbeam, European hornbeam	Tree			ok	ok	
Տխլենի սովորական	Common hazel	Tree or shrub			ok	ok	
Գայլուկ սովորական	Common hop	Annual-biennial wrapping herb			ok		
Կտտկենի սև	Black elder, European elder, European elderberry	Small tree or shrub			ok		ok
Գևրիմաստի	Wayfarer, Wayfaring tree	Shrub			ok		
Փռշնի կովկասյան	Caucasian hackberry	Tree			ok	ok	
Հոն սովորական	Cornelian cherry, European cornel, Dogwood	Tree	ok		ok	ok	
Հոն սովորական	Common sea-buckthorn	Tree or shrub	ok		ok	ok	ok
Ռոբինիա կեղծ ակացիա	False acacia, Black locust	Tree	ok	ok	ok	ok	
Կաղնի վրացական	Georgian oak	Tree			ok	ok	
Ընկուզենի սովորական	Common walnut, Persian walnut, English walnut	Tree			ok		
Թզենի սովորական	Common fig	Tree	ok				
Թթենի սպիտակ	White mulberry	Tree	ok				
Հացենի սովորական	European ash, Common ash	Tree		ok	ok	ok	
Ժանտափուշ, Ցաքի փշոտ	Jerusalem thorn, Garland thorn, Christ's thorn	Shrub				ok	ok
Դժնիկ լուծողական	Common buckthorn	Tree or shrub	ok	ok			ok
Ծիրան սովորական	Armenian plum	Tree	ok				
Ալոճ, Սգնի	Hawberry	Tree			ok		
Ալոճ, Սգնի կովկասյան	Hawberry	Tree			ok		
Ալոճ, Սգնի հինգսոնականի	Hawberry	Tree			ok	ok	
Ալոճ	Hawberry	Tree			ok	ok	
Սալոր, Ճլոր	Cherry plum	Tree	ok				
Սալոր փշավոր, Մամխի	Black thorn	Tree		ok	ok		
Տանձենի սովորական	European pear	Tree	ok				
Մասրենի	Rosebush	Shrub			ok		
Մասրենի շան	Dog-rose	Shrub		ok	ok		
Մասրենի գարշահոտ	Austrian briar	Shrub			ok		
Մասրենի սուրբատամնավոր	Rose	Shrub			ok		
Մոշենի անատոլիական	Holy bramble	Shrub		ok	ok	ok	ok
Մոշենի	Arctic raspberry	Shrub			ok	ok	
Մորենի, Ազնվամորի	Red raspberry	Semishrub			ok	ok	ok
Ուռենի սև	Black poplar	Tree	ok		ok	ok	
Ուռենի սպիտակ	White willow	Tree			ok	ok	
Այծուռենի, Որձուռի	Goat willow, Pussy willow	Tree	ok		ok		
Ուռենի բարձր	Crack willow	Tree			ok		
Ուռենի եռառէջ	Almond willow	Tree				ok	
Երկնաձառ բարձրավուն	Tree of Heaven, Stinking sumac, Chinese sumac	Tree	ok	ok	ok	ok	
Լորենի բեգոնիատերև	Basswood	Tree	ok				
Լորենի սրտաձև	Littleleaf linden	Tree	ok				
Թեղի ողորկ	European White-elm, Fluttering elm	Tree			ok	ok	
Թեղի փոքր	Field elm, European *field elm*	Tree		ok	ok		
Խաղող մշակովի	Common grape vine	Liana	ok		ok		ok

Արձանագրություն N 2

«ՏԾԻԳ-ԲԸԱԾՁԲ-2016/2» ծածկագրով բաց ընթացակարգի գնահատող հանձնաժողովի նիստի

ք. Երևան «19» մայիսի 2016թ.
ժամը 16:00

Մասնակցում էին՝
Հանձնաժողովի նախագահող՝ Ք. Քաբաբյանը
Հանձնաժողովի անդամներ՝ Կ. Գասպարյանը և Ա. Պապյանը
Հանձնաժողովի քարտուղար՝ Ա. Մովսեսյանը
Բացակայում էր՝
Հանձնաժողովի նախագահ՝ Ք. Քաբաբյանը

I. Բաց ընթացակարգի հայտերի բացման մասին
(Կ. Գասպարյան)

1. Աշխատանքային անհրաժեշտությունից ելնելով գնահատող հանձնաժողովը որոշեց նիստը ընդհատել և շարունակել 2016թ. մայիսի 26-ին, ժամը 16:00-ին, ՀՀ ք. Երևան, Նալբանդյան 28, ՀՀ տրանսպորտի և կապի նախարարություն 3-րդ հարկ, N 307 սենյակ հասցեում:

Ընդունվել է որոշում՝ կողմ՝ 2, դեմ 0:

Հանձնաժողովի
Նախագահող՝ _____ Կ. Գասպարյան

Անդամներ՝ _____ Ա. Պապյան

Քարտուղար՝ _____ Ա. Մովսեսյան