Design and Construction of the New Bagratashen–Sadakhlo Bridge

“Application for Preliminary Phase of Expert Examination”

December 23rd, 2018
## Table of Contents

<table>
<thead>
<tr>
<th>Heading</th>
<th>Page Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Purpose of this Document</td>
<td>3</td>
</tr>
<tr>
<td>2. Project Background</td>
<td>3</td>
</tr>
<tr>
<td>3. Purpose of the Proposed Project</td>
<td>4</td>
</tr>
<tr>
<td>4. Project Characteristics</td>
<td>5</td>
</tr>
<tr>
<td>4.1. Location</td>
<td>5</td>
</tr>
<tr>
<td>4.2. Capacity and Scale</td>
<td>5</td>
</tr>
<tr>
<td>4.3. Construction Method</td>
<td>8</td>
</tr>
<tr>
<td>4.4. Use of Natural Resources and Materials</td>
<td>10</td>
</tr>
<tr>
<td>4.5. Alternative</td>
<td>10</td>
</tr>
<tr>
<td>5. Description of Project Area</td>
<td>12</td>
</tr>
<tr>
<td>5.1. Climate</td>
<td>12</td>
</tr>
<tr>
<td>5.2. Hydrology</td>
<td>12</td>
</tr>
<tr>
<td>5.3. Geology and Seismic Condition</td>
<td>12</td>
</tr>
<tr>
<td>5.4. Soil</td>
<td>13</td>
</tr>
<tr>
<td>5.5. Geomorpholgy and Landscapes</td>
<td>13</td>
</tr>
<tr>
<td>5.6. Existing Site Conditions</td>
<td>14</td>
</tr>
<tr>
<td>5.7. Natural Habitats and Biodiversity</td>
<td>15</td>
</tr>
<tr>
<td>6. Baseline Study</td>
<td>15</td>
</tr>
<tr>
<td>7. Potential Impacts</td>
<td>16</td>
</tr>
<tr>
<td>7.1. Impacts of Construction</td>
<td>16</td>
</tr>
<tr>
<td>7.2. Impacts of Operation</td>
<td>17</td>
</tr>
<tr>
<td>8. Mitigation Measures</td>
<td>18</td>
</tr>
</tbody>
</table>
1. **Purpose of this Document**

   This document is prepared for submission of the proposed project “Design and Construction of the New Bagratashen–Sadakhlo Bridge” in the transboundary context of Armenian-Georgian governments to the Ministry of Nature Protection following legislative framework:

   **Application for Preliminary Phase of Expert Examination:** *Law on Environmental Impact Assessment and Expert Examination of the Republic of Armenia (2014)*

   A separate application is being submitted to the Ministry of Environmental Protection and Agriculture in Georgia as a “Scoping Application” under the Environmental Assessment Code of Georgia (2017)

2. **Project Background**

   The "Agreement on the construction of a new bridge over river Debed at the Sadakhlo-Bagratashen border crossing points on the state border of Georgia and the Republic of Armenia" was signed between the Government of Georgia and the Government of the Republic of Armenia on 24 December 2014.

   The Ministry of Transport, Communication and Information Technologies of the Republic of Armenia and Ministry of Regional Development and Infrastructure of Georgia intends applying the proceeds of loans from the European Bank of Reconstruction and Development towards the cost of implementation of design and construction of new bridge over river Debed at the Sadakhlo- Bagratashen border crossing point.
The design and construction of the bridge (Contract N CW-SBB-01) will be carried out within the framework of the tripartite contract – contractor and two employers:

**Employer (1):** Ministry of Transport, Communication and Information Technologies of the Republic of Armenia and its agent Transport Project Implementation Organization (SNCO) Acting on the basis of the Agency Agreement, dated 26.05.2010

**Principle place of business:** 4, Tigran Mets, Yerevan, Republic of Armenia

**Employer (2):** Roads Department of Georgia- the state juristical institution under the governance of the Ministry of Regional Development and Infrastructure of Georgia

**Principle place of business:** 12 Al. Kazbegi ave., 0160, Tbilisi, Georgia

### 3. Purpose of the Proposed Project

Bagrashen-Sadakhlo is the main land transport corridor connecting Armenia and Georgia with the rest of the world. An upgrade of the existing infrastructure that allows safe transit of people and goods across the border is essential. The current poor quality of existing bridge, due to its weary life-time and maintenance condition, arises safety concerns. Also, the insufficient capacity of the existing bridge is a cause for significant congestion in terms of regional traffic flows. Consequently, the construction of a new bridge with an increased processing capacity that will meet national and international standards is considered.
4. Project Characteristics

4.1. Location

The project and its construction site will extend within the Sadakhlo-Bgratashen Border Crossing Point on the border between Armenia and Georgia which is located on Highway M6 Yerevan-Tbilisi; 60 km from Tbilisi and 200 km from Yerevan. The coordinates of the project: UTM(486150,4564180).

![Project Location](image)

Figure 1- Project Location

4.2. Capacity and Scale

Considering the plan and the longitudinal profile presented in the contract, the structure designed for the bridge comprises two separate decks of five 32-meter spans each. According to the current site conditions, the preliminary design has considered minimal manipulations during construction and operation of the bridge.
The overall length of the bridge would be 160 meters between the bridge bearings over the abutments.

The following items were considered in planning the above array:
- The piers are positioned along the river flow
- The decks are identical to accelerate and facilitate construction
- Walling is kept minimum
- Required clearance of the existing railroad is met
- Considering maintenance issues, the proposed steel beams are replaced with a prestressed concrete deck
- The most economically efficient structural system is selected
The substructure of the bridge comprises reinforced concrete single-column circular piers of 2.0-meter diameter with column headings. Also, shallow foundations are considered regarding the documentations and data collected from the rock-bed construction site. Pre-stressing of the column headings in this plan can help decrease the height of the columns and their cross-sectional area. Height and cast-in-place slab of 0.25-meter thickness. Each deck has five girders positioned within 2.35 meters from each other. The girders weigh about 50 tons each, and four 0.6-inch cables with 9 strands are used to prestress them. Precast concrete slabs can be used for the formworks in order to accelerate the operation. The deck is designed to be a simple span, and each span has buried joints at both ends, featuring below specifications:

- Feasible construction
- Optimal construction costs compared to similar decks
- Shorter construction time as the girders can be made along with the piers
- Lower maintenance costs
- Easy installation requiring minimum equipment considering the conditions of the site and topography of the area
To provide the automotive road overpass within the Armenian territory (M3 route) corrugated steel plate will be used. Also, considering the surrounding flora, natural plantations can be used to cover the fills and serve aesthetic goals.

![Sample of using prefabricated tunnel designs](image)

Railroad clearances are considered according to coordination made with the Georgian Railways (letter No 3615 dated 24.06.2016) in the issues related to safe movement of trains, which indicates clearance distances of at least 6.4 meters for railroad overpass and 3.1 meters from railroad axis.

4.3. Construction Method

The workshop planning will be carried out according to the site organization plan (appendix 1). The plan includes construction site, fencing, access road on the Georgian side, access ramp on the Armenian side, staff offices, Engineer’s office, labor camp, material depot and handling area, prestressing girders workshop, rebar workshop.

Given the structural plan (Figure 1), Piers P2 and P3 are located inside the river flow. Thus, the construction of these piers, including their foundations, columns, and girder placements will be carried out over a push-up platform. The construction work will generally proceed through the steps below:
1- Earthwork at the southern connection point -from the bridge abutment to the existing pavement at the Georgian BCP- will be carried out and the fill area will be compacted for use during construction.

2- Arrangements will be made (by the employer) for appropriate displacement of the existing telecommunication facilities.

3- The pushup platform will be constructed along the Armenian river embankment and will extend far enough into the river to ensure safe condition for construction equipment. Prior to the push up, the opposite side of the river will be cut just enough to compensate for the reduced river section.

4- Piers’ foundations will be excavated and the local excavated material will be stored for backfill use.

5- In-situ rebarred concrete will be applied for the piers and their foundations and caps.

6- Cranes will place the precast girders over the caps as soon as they reach their bearing capacity.

7- The pushup platform will be removed while carrying out the bridge deck and installing its elements.

8- Steps 2 through 7 will repeat on the Georgian side after the pushup platform is removed on the first side. Prior to initiation, arrangements will be made for railroad protection.

9- The rest of the work including the middle-span construction will be carried out at the bridge deck elevation and away from the river.

10- The Prefabricated tunnel-shaped corrugated stainless steel openings will be installed and their covering will be applied after their foundation is carried out.

11- The final step will be the finishing works such as asphalt pavement, expansion joints, traffic signs and railings, etc.
4.4. Use of Natural Resources and Materials

According to the design, it is estimated that the bridge structure will require approximate amounts of 3300 m$^3$ concrete and 800 tons steel for rebars. The railings will weigh 64 tons and the prestressed cables 100 tons. Other major material resources will include soil fill and Bitumen. Various installations and finishing works are also part of the bridge material composition.

The sources of major material are considered:
- Cement provided from Armenia, Iran and Georgia
- Sand and gravel provided from Armenia UTM(491894,4560499) at some 10km driving distance for site; and Georgia UTM(489668,4577273) at some 20km driving distance from site (locations shown in Appendix 2)
- Steel provided from Georgia and Iran
- Prestressed cables and material provided from Iran

4.5. Alternative

The alternatives to the current design generally involve the elimination of the prefabricated tunnel section.

Alternative 1- Two 6-span bridges with five piers that connect to the Gergian side over an abutment and the Armenian side over a retaining wall.

Alternative 2- Two 7-span bridges with six piers that connect to both sides over abutments.
Figure 5 - Profile view of Bridge Design (Alternative 1 of Project)

Figure 6 - Profile view of Bridge Design (Alternative 2 of Project)
5. Description of Project Area

5.1. Climate

Project area is located in the subtropical climatic zone. The average air temperature in July varies between 20 and 22°C. The average air temperature in January varies between 0 and -2°C, with mild snow-free winters. The annual amount of precipitation comprises 500-600mm.

5.2. Hydrology

5.2.1 Surface water

The Debed River is formed by the confluence of the Dzoraget and Pambak rivers. It flows through the Gugarats ridge in a total length of 178km forming the Debed canyon. Its catchment area is 4080 km². The Debed River runs through Georgia in its lower reaches. Its length is 151 km, and catchment area is 4080 km² in Armenia down to border. The average discharge of Debed is 34 m³/sec that varies between 15 m³/sec in January and 82 m³/sec at May. The high flow season is April through June. Debed water is used for irrigation.

5.2.2 Groundwater

Some drinking water is supplied from wells at surrounding residential areas.

5.3. Geology and Seismic Condition

Studied materials including the geological maps of Georgia and Armenia, indicate the area’s geological structure as volcanic rocks of Middle and Upper Jurassic that are generally covered by Cretaceous and Quaternary formations with cut-through Quaternary intrusions at some locations. Quaternary formations are represented by
basalts lava which is covered by modern alluvial-delluvial, alluvial-prolluvial formations of macro-fragmental argillo-arenaceous composition at some places.

According to article 5.2 and appendix B seismic construction norm of Armenia, Bagratashen City is located in an area with the peak ground acceleration of 2 m/s² (equivalent to 0.2g PGA) that is consistent with the zonation maps of the republic of Armenia and Georgia in accordance with World Health Organization.

5.4. Soil

The project site is located in the region of Mountain-forest brown soil class that is characterized by carbonate subtype. Soil layer is generally less than 30cm thick and fertile for agriculture.

5.5. Geomorpholgy and Landscapes

Debed River flows within a fairly tight valley surrounded by completely rough morphology at upstream. The morphology however, becomes smoother on the route between Ayrum and the Armenian-Georgian border, over which irrigated agricultural lands are developed. The Debed River flows to the north and proceeds with a remarkable bend near the border (between Ayrum and Haghtanak) and continues its east-west route into Georgia. The morphology of the valley is mainly open-V from Pambak to Haghtanak, and open-U after that. The valley is relatively smooth at the bridge site, and the river flows within embankments 10-15 meters high.
5.6. Existing Site Conditions

The project site lies within political administrative boundaries of Georgia and Armenia. At Georgia, it is located in Kvemo Kartli Region within Marneuli District. At Armenia however, the project is located in Tavush Marz, and belongs to the Ayrum community.

Sadakhlo-Bagratashen border crossing point is the most important and heavily-loaded border crossing point between Armenia and Georgia. The statistics on the volume of cargo flows through “Sadakhlo-Bagratashen” BCP indicates the passage of 745’101 vehicles in both directions for 2015.

The Armenian and Georgian Border Points are paved areas on which some customs offices and the police border buildings are located. In addition, on the Armenian side, few privately-owned commercial (hotel, market, restaurant) and residential structures exist. The use of available water supply, gas and electric power are sought for construction use. Some telecommunication cables exist at both embankments. The following environmentally project-related infrastructures exist:

- The connecting M6 (Armenia) and E001 (Georgia) Highways
- The underpassing M3 Road, which used to be customs road before the BCP upgrade. Replaced with a new route, this 21-meter wide route it is now only an access for a hotel, two residential homes and the border police.
- The underpassing Yerevan-Tbilisi Railroad that passes along the Georgian bank of Debed River and the project will span over it.
- An underpassing irrigation canal on the Armenian side
- A septic tank with untreated wastewater discharge at UTM(486216,4564252)
- The existing bridge
5.7. Natural Habitats and Biodiversity

The nearest protected nature area in Armenia to the project site is the Zikatar State Sanctuary located at 14km Southeast. Whereas, the nearest in Georgia is Gardabani Managed Nature Reserve 35km to the east.

Two distinct landscape zones of Flat Plains and Mountain Ecosystems are the main terrestrial ecosystems. The flat plains are covered by agricultural lands.

Debed River is the aquatic ecosystem in the area, including its riparian vegetation is an important component.

6. Method

6.1. Baseline Study

Baseline condition is initially identified via the most efficient use of available library data. Field visit and inspections are planned accordingly to verify library data and observe the project site’s condition closely. Attempt will be made to fulfill the gaps and express the baseline condition through expert judgement drawn from field observation. Where measurements are not available for impact-related variables, necessary sampling and data measurements will be carried out once prior to construction. Although rationally, such measurement provides one capture of the baseline condition (rather than a time series), it will serve as the only base point for monitoring the Project’s impacts. The baseline study will cover:

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<th>(1) Physical Environment</th>
<th>Climate (Precipitation, Rainfall, Snowfall, Temperature, Wind)</th>
</tr>
</thead>
<tbody>
<tr>
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<td>- Air Quality and Noise Levels</td>
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<td>- Water Resources (surface water, groundwater)</td>
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<td>- Geology and Siesmology (Regional Geology, eimsmology, Techtonics, Soils and Erosion)</td>
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</tbody>
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6.2. Impact analysis

Impacts will be analysed in terms of their nature (positive/negative), direct/indirect, duration (temporary/permanent), significance, intensity and likelihood.

7. Potential Impacts

The environmental and social impacts associated with the bridge are relatively site-specific. As the project is located at the Armenia-Georgia border crossing point, it pertains transboundary impacts. Most adverse environmental impacts relate to the construction phase.

7.1. Impacts of Construction

The most significant impacts during construction are sought to be:

- Removal of riparian flora for construction of abutments, piers and foundations
- Removal of flora for the access road on the Goergian side and the access ramp on the Armenian side
- Disturbance of river morphology for water diversion purposes and the construction of push up platforms at bridge section
- Impact on Debed’s water quality due to washing of the push-up platform material
- Indirect impact on fauna due to the disturbance of river and its riparrian flora
- Production of solid waste, additional wastewater from on-site labor camps and office buildings that may pollute water and / soil
- Impact on small businesses at the Armenian BCP (Hotel, market, restraunt)
- Impacts of unpredicted events (accidents, natural hazards)
- Land acquisition may be applicable according to the workshop organizational site map
- Impact on cultural heritage may apply if excavations reveal any object of cultural heritage

7.2. Impacts of Operation

The general socio-economic impacts of the project are positive, mainly in terms of socio-economy. However, notable impacts during operation are associated with:

- Noise and emissions of vehicle traffic
- Road safety
- River water pollution due to bridge runoff
- Varied landscape and aesthetics due to creation of a new feature
- Impact on river flow/ morphoogy condition (especially during flood events) due to the positioning of piers and abutments
- Impact on local businesses at the BCP*

*(The EBRD’s PSD indicates that a small number of business owners received compensation for the loss of their business and they were adequately compensated at the time of the due diligence.)*

8. Mitigation Measures

Effective stakeholder engagement is essential to ensure the reliability of developed applicable mitigations. The environmental action plan aimed at exclusion, reduction and compensation of the harmful impact on the environment will include:

- Minimize the area of influence of construction work and protect adjacent flora from destruction
- Minimize access routes
- Expedite construction as much possible
- Apply low-impact material for push-up platforms
- Ensure machinery pass standard inspections
- Appropriate and near-site workshop organization
- Implementation of waste management plan
- Planned total workshop area and access roads on community land
- Make arrangements for appropriate wastewater disposal of labor camp and office sites or treatment of existing septic tank discharge
Mitigations will be organized into a framework to develop social and environmental management plans. The final outcome of the study will be carved into Environmental and Social Management and Monitoring Plans (ESMMP).
Appendix 2- Sand and Gravel Borrow Areas (Armenia)
Appendix 2- Sand and Gravel Borrow Areas (Georgia)