



Technical Assistance Consultant's Report

Project Number: 48414-001/TA 8950-UZB
January 2020

Uzbekistan: Third CAREC Corridor Road Investment Program (Financed by the Technical Assistance Special Fund)

Central Asia Regional Economic Cooperation Corridor 2 Karakalpakstan Road (A380 Kungrad to Daut-Ata Section) Project

Prepared by SHELADIA Associates Inc. USA in association with Infrastruktura Lohiya Byurosi LLC Uzbekistan (CBI)

For Government of Uzbekistan
Committee for Roads

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Asian Development Bank

PPTA FOR THIRD CAREC CORRIDOR ROAD INVESTMENT PROGRAM, PHASE 1

Funded by:

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Asian Development Bank

Committee for Roads of the Republic of Uzbekistan



Consultant's Final Report for Karakalpakstan Road Project



January 2020



**SHELADIA Associates Inc. USA in association with
Infrastruktura Loyiha Byurosi LLC, Uzbekistan (CBI)**

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PROJECT PREPARATORY TECHNICAL ASSISTANCE FOR THIRD CAREC CORRIDOR ROAD INVESTMENT PROGRAM, PHASE 1

CONSULTANT'S FINAL REPORT FOR Karakalpakstan Road Project A380, km 964 – km 1204 (Kungrad to Daut-Ata section) January 2, 2020

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List of Abbreviations

AASHTO	American Association of State Highway Transport Officials
AC	Asphalt Concrete
ADB	Asian Development Bank
AM	Aide Memoire
ASTM	American Standard Testing Methods
BOQ	Bill of Quantities
BS	British Standards
CBI	Consulting Bureau for Infrastructure (Infrastruktura Loyiha Byurosi LLC)
CBR	California Bearing Ratio
CR	Committee for Roads of the Republic of Uzbekistan under the Ministry of Transport
DPR	Detailed Project Report
EA	Executing Agency
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
FS	Feasibility Study
IA	Implementing Agency
IEE	Initial Environmental Examination
LHS	Left Hand Side
LTP	Lead Technical Professional
MFF	Multi-tranche Financing Facility
NH	National Highway
NPV	Net Present Value
NSDP	Net State Domestic Product
O/D	Origin/Destination
PCU	Passenger Car Unit
PSA	Poverty and Social Assessment
PPTA	Project Preparatory Technical Assistance
QA	Quality Assurance
QAR	Quality Assurance Reviewer
RDI	Road Design Institute (Yo'l Loyikhasi Byurosi LLC)
RHS	Right Hand Side
ROW	Right of Way
RRF	Republican Road Fund of the Republic of Uzbekistan
SH	State Highway
ShNK	Architectural Rules and Regulations
SPS	ADB's Safeguard Policy Statement (2009)
SHELADIA	SHELADIA Associates Inc.
TOR	Terms of Reference
TRTA	Transaction Technical Assistance
URM	Uzbekistan Resident Mission
VC	Video Conference
VDF	Vehicle Damage Factor

A. Executive Summary

1. With the objective of promoting regional integration and boosting economic activity, in 2016 the Asian Development Bank (ADB) proposed Multi-tranche Financing Facility (MFF) for the Third Central Asia Regional Economic Cooperation (CAREC) Corridor Road Investment Program. The MFF would rehabilitate 364 km of international corridor highways in the Republic of Karakalpakstan, Khorezm and Kashkadarya regions of Uzbekistan. A critical step in the development of the CAREC Corridor initiative, the Investment Program would provide the last “missing link” in connecting the CAREC corridors to the international border with Kazakhstan.
2. The initial MFF program contained three tranches, out of which the first tranche (Kashkadarya road project) was processed as a standalone project in 2016 and the second tranche was the 240 km long section from km 964 to km 1,204 on A380 highway (Kungrad to Daut-Ata section). However, it turned out that the project documentation was not fully available till autumn 2016. Following the governmental changes in Uzbekistan after September 2016, the project priority changed and it was put on hold. In October 2018 SHELADIA was assigned as Transaction Technical Assistant Consultants for the due diligence of the reconstruction of the section from km 964 to km 1,204 on A380 in the Republic of Karakalpakstan, which is referred to as Karakalpakstan Road Project.
3. The TRTA covers the due diligence of the detailed design including safeguards aspects, road safety audit and the economic analysis. The tasks also include the preparation of the bidding documents for the civil works and road maintenance and the terms of reference for the site supervision consultant. Technical due diligence activities were undertaken based on the detailed design documentation made available by RDI. The main goal was to ensure that the technical design solutions are in compliance with design guidelines in force in Uzbekistan and reflect good international practice. Environmental and social safeguard studies were undertaken to ensure that the project would comply with ADB safeguard policies and national laws. For the procurement of civil works a procurement plan including the procurement risk analysis were elaborated. The following documents have been prepared for the Karakalpakstan Road Project:
 - Design Review Report and Bid Documents
 - Environmental Impact Assessment including EMP
 - Biodiversity Assessment
 - Summary Poverty Reduction and Social Strategy
 - Poverty, Social and Gender Analysis
 - Gender Action and Community Development Plan
 - Land Acquisition and Resettlement Plan
 - Procurement Assessment Report
 - Financial Management Assessment Report
 - Road Safety Audit Report
4. The project road is located in the Kungrad district of the Republic of Karakalpakstan and has a total length of 240 km. It starts at km 964 on A380 highway and runs towards the Kazakh border at km 1,204. No settlements are being passed by the project alignment. The settlements of Jasliq (ca. km 1,047) and Karakalpakiya (ca. km 1,183) are located to the left of the project road at more than 1 km distance.
5. “Yul Loyikhasi Byurosi LLC” (Road Design Institute) was assigned to carry out the works for the preparation of the Feasibility Study for the 240 km long road section from km 964 to km 1,204 of A380 by the Republican Road Fund of Uzbekistan in 2016.
6. Field works had started in the same year and comprised among others topographical survey, geotechnical investigations including laboratory testing, traffic counts, road condition survey and culvert inventory works. The FS was completed by RDI in 2017. In 2018, after changes in the institutional arrangements, RDI was assigned by the State Committee of the Republic of Uzbekistan for Roads to update the FS by amending the initially foreseen asphalt concrete pavement to cement concrete pavement and to elaborate the Detail Design.
7. The field works carried out by RDI are assessed to be to sufficient detail including testing and inventory works for the preparation of FS and DD documents. A satisfactory construction material

basis is available in the project region, taking into account the proposed design solutions, e.g. the use of cement concrete pavement, although aggregates for the pavement layers have to be hauled from certain distances. The existing road pavements reached the end of their useful life and shall be replaced.

8. Own traffic counts of SHELADIA team were conducted in the period from March 28 to 31, 2019. One O/D survey was carried out for 10 hours on April 1, 2019. Both, the traffic data provided by RDI and own traffic data were used to develop traffic forecasts. According to them, the road shall be rehabilitated as a category II road with 2 lanes. The economic analysis with HDM-IV modelling based on the cost estimates provided by RDI was conducted.
9. New pavement structures as designed by RDI are assessed to be in general adequate. However, some constructive improvements of the cement concrete top layer, e.g. the intervals of dowels and anchors for joints and the depth of joint cuts should be considered as per best international practice.
10. The project area is located in the Ustyrt Plateau, having in general a flat terrain. No clearly designated waterways do exist. However, new culverts with collecting basins on both sides were placed at low points of the alignment to allow the discharge of water from one side to the other and to prevent snow being blown to the road surface during windy weather. No hydraulic calculations have been carried out by RDI due to the lack of clear catchment areas and basins in the project area. SHELADIA team reviewed the number and location of proposed culverts and assesses them to be appropriate.
11. Neither existing bridges are located in the project section nor are new ones required. The project road crosses a railway line at grade at km 85+587.02, which is a branch from the main railway track to the Kazakh border. It only connects to a restricted area and ends after ca. 4.6 km from the level crossing. The number of trains per month is very limited. RDI achieved consent from the railway authority that a grade separated railway crossing by means of a structure is not required.
12. The road design is based on the standards in force in Uzbekistan, e.g. ShNK 2.05.02-07 "Design of roads and highways". Although design speeds and geometric characteristics of them are often slightly higher than in Western Europe, which makes them less economically efficient, they have to be followed to successfully undergo the state expertise.
13. Drawings produced by RDI shall be bilingual, i.e. in the Russian and English languages. Plan drawings do not display some details which are considered to be helpful for a proper understanding of the design solution. However, it shall also be noted that in comparison with the 2016 Kashkadarya Regional Road Project DD, drawings have improved and the initial comments submitted by SHELADIA end of 2018 for the Karakalpakstan Road Project are addressed as deemed reasonable by RDI. The Consultant shared detailed comments to the set of drawings made available by RDI on December 28, 2018 on March 14, 2019. They are addressed as deemed appropriate in the final set of drawings, received on April 24, 2019 from RDI.
14. Taking into account the above-mentioned concerns, the DD documentation of RDI for the 240 km of the A380 Road Project from km 964 to km 1204 is generally assessed to be appropriate to be used for the implementation of the project.
15. Detail design documentation including BOQ, cost estimates and technical specifications were prepared by RDI. They are based on national design guidelines and regulations and were reviewed by TRTA team.
16. The executing agency is the Committee for Roads under the Ministry of Transport. A Project Management Unit was established to coordinate and manage the TRTA activities and subsequent implementation of the project.
17. In June 2019 ADB issued a variation to SHELADIA's contract. The Government of Uzbekistan (the Government) requested the Asian Development Bank (ADB) to include a pilot axle load control program on national roads with installation of Weigh-in-Motion (WIM) axle load control stations at 3 selected locations on A373 and M39 highways under the proposed Karakalpakstan Road Project. The Consultant was requested to undertake the social and environmental due diligence for the locations selected for installation of the WIM stations under the additional Technical Assistance (TA) services for the Karakalpakstan Road Project.

B. Introduction

B.1 Background and Objectives

18. In 2016 the Government of Uzbekistan had requested for a project preparatory assistance (PPTA) to carry out due diligence and prepare a comprehensive design under the Third CAREC Corridor 2 Road Investment Program. The Asian Development Bank (ADB) financed the PPTA. The investment program was initially proposed as a Multi-tranche Financing Facility (MFF), which would rehabilitate 364 km of international highways in the Republic of Karakalpakstan and the Khorezm and Kashkadarya regions of Uzbekistan. The initial MFF program contained three tranches, out of which the second tranche was the 240 km long section from km 964 to km 1,204 on A380 highway (Kungrad to Daut-Ata section). However, it turned out that the project documentation was not fully available till autumn 2016.
19. In October 2018 SHELADIA was assigned as Transaction Technical Assistant Consultants for the Karakalpakstan Road Project, which was proposed as tranche 2 of the original MFF. The anticipated scope of works is presented in the TOR, which are attached to this report. The AM of ADB's consultation mission in November 2018 also describes the tasks to be carried out by the TRTA Consultant. An overview of the location of the project section from km 964 to km 1204 on A380 subject to the TRTA is given at the end of chapter 2 below.
20. The TRTA (i) conducted technical due diligence reviewing the detailed engineering design and drawings to ensure consistency and sufficiency for bidding including road safety audit, BOQ and specifications; (ii) prepared social and environmental safeguards documents including preparation of EMPs; (iii) reviewed and updated the economic and financial analysis; (iv) updated the procurement assessment; and (v) assisted the Executing Agency in preparing bid documents including preparation of TOR for the site supervision consultant.
21. The TRTA (i) developed an investment program bankable by ADB loan; (ii) conducted due diligence for technical, economic, financial, social and environmental viability of the project; (iii) assisted the Executing Agency in developing required documentation for country resource allocation; and (iv) assisted the Executing Agency in procuring contracts and managing safeguard issues. As per June 2019 variation the Consultant also undertook the social and environmental due diligence for the proposed Weigh-In-Motion (WIM) axle load control stations.
22. Identified by the Government as a priority road development program (Resolution of the President of the Republic of Uzbekistan No 2313 on the Program of Development and Modernization of the Engineering-Communication and Road and Transport Infrastructure for the period 2015-2019, dated March 6, 2015), the output anticipated for the Karakalpakstan Road Project are (i) the rehabilitation/construction of the international road section from km 964 to km 1,204 on A380 connecting to the Kazakh border; (ii) supply and installation of intelligent transport systems in a pilot section of A373; and (iii) supply and installation of WIM at 3 selected locations, 1 on M39 and 2 on A373. The 240 km long design road section will be constructed to a category II road in accordance with the design guideline ShNK 2.05.02-07.
23. The executing agency (EA) for the project is the Committee for Roads of the Uzbek Republic (CR). The order to establish the CR was given by the resolution of the President of Uzbekistan on February 1, 2019. A Project Management Unit (PMU) was established as implementing agency. After ADB's approval of the Karakalpakstan Road Project, it shall be implemented by the implementation agency, the PMU.
24. To assist the Executing Agency in the preparation of the project, ADB has engaged SHELADIA Associates, Inc. (SHELADIA), in association with the Consulting Bureau for Infrastructure (CBI) to provide the required consulting services under the TRTA. The original PPTA consultancy contract, which was signed on 24th February 2016 following contract negotiations in the period 23-24 February 2016, has been extended till end of March 2020 and is still in force. The VO for the provision of services for the Karakalpakstan Road Project was issued by ADB in October 2018.

B.2 General Description of the Route

25. Start of the project road is at km 964 of A380 with design chainage km 0+000, at the end of the previous road section already contracted for rehabilitation. The project alignment follows the existing A380 road only in some sub-sections, namely from km 0 to approx. km 10, from km ca. 79 to km ca. 110 and from km ca. 219 to the end (km 240). In the other sub-sections, the design route mainly runs on an abandoned old gravel/earth road in various distance to the left of the existing A380. The DD was prepared in 40 km long sub-sections to expedite the design works, using a continuous design chainage throughout the full project road length.

B.3 Major Nodes

26. There are no junctions with other major roads in the whole 240 km long project road section. However, minor roads connecting the railway stations located left from the project alignment to A380 are being crossed. At these locations new junctions have been designed according to local standard and the layout drawings for them are contained in the DD of RDI. Junctions included in the design of RDI are shown in the following table.

Table 1: Junctions along the Project Road

Chainage	Type of Junction
A380, km 964 to km 1204	
km 0.769	Cross Road
km 1.877	Cross Road
km 5.194	Cross Road
km 8.969	T-Junction
km 37.484	Cross Road
km 43.678	Cross Road
km 66.168	Cross Road
km 85.221	Cross Road
km 109.562	T-Junction
km 134.222	Cross Road
km 156.269	Cross Road
km 180.360	Cross Road
km 196.493	Cross Road
km 198.825	T-Junction
km 198.970	T-Junction
km 201.149	Cross Road
km 219.760	T-Junction
km 236.211	T-Junction
km 239.627	T-Junction



Figure 2: Overview of Karakalpakstan Road Project location

B.4 Performance of the Study

B.4.1 Staff Mobilization

27. The SHELADIA Team Leader, Mr. Thomas Voigt was mobilized on November 12, 2018 to the field to accompany the ADB consultation mission with regard to the 240 km road section from km 964 to km 1,204 on A380 (Kungrad to Daut-Ata section). Before his arrival to Tashkent, the documentation of the 2017 FS was collected from home by support of the local partner, the Consulting Bureau for Infrastructure (CBI), in electronic format to already familiarize with the project road section in general. Introductory meetings with the local staff and PMU were not deemed to be necessary, because having completed the PPTA for tranche I of the MFF in 2016, all key persons of PMU, ADB and the Consultant know each other. During the ADB consultation mission a work space for the Team Leader was provided in the "Poytakht" Business center, 16, Sh. Rashidov Ave., Tashkent, Uzbekistan on 9th floor at PMU office.
28. During the field input till November 29, 2018 first DD plan and profile drawings, cross section drawings, typical cross section and other typical drawings were submitted by RDI to the Consultant. The Consultant started with a first review of them and shared comments with RDI for consideration. After returning back home, further DD drawings were received from RDI by electronic means, so that the Consultant continued reviewing the initial DD drawings. Suggestions for revision were shared with RDI by email subsequently in the first half of December 2018. RDI agreed to address the comments regarding some missing transition curves in the horizontal alignment, a few missing vertical curves respectively too big radii applied, unnecessary high embankments in some sub-sections and a few missing junctions at existing access roads.
29. The SHELADIA Team Leader was mobilized on December 17, 2018 as agreed with the ADB for the next field input. He has mobilized to the site and has quickly initiated meetings with the staff of the local partner, the Consulting Bureau for Infrastructure (CBI). All national experts of CBI are aware of their principal tasks and are ready to give needed inputs at any time. Support staff was mobilized for translation and office administration tasks. Other key members of the team have mobilized as agreed taking into account the updated work and personnel schedules as well as the availability of the DD and other needed documents in English.

B.5 Structure of the Report

30. This Interim Report comprises of eleven chapters. A brief description of the content of each chapter is given below:
 - Chapter A: Executive Summary – gives a general overview of the tasks carried out under the TRTA.
 - Chapter B: Introduction – gives a brief introduction on project background and performance of the study.
 - Chapter C: Brief Overview of the Economy of Uzbekistan – provides some major data of Uzbekistan's economy.
 - Chapter D: Environmental Policy, Legal and Institutional Framework – explains the environmental legislation, standards and framework to be followed in the preparation of the EIA.
 - Chapter E: Social Safeguards – describes the socio-economic profile of the project region and provides information on poverty and social assessment and resettlement.
 - Chapter F: Road Development and Road Sustainability – describes the expected outputs of the road improvement.
 - Chapter G: Detailed Design and Cost of Karakalpakstan Road Project – review of the DD documentation, assessment of design standards and horizontal and vertical alignment, material investigations, pavement design and cross drainage structures are presented in this chapter.
 - Chapter H: Economic analysis – provides information about economic viability of the project.
 - Chapter I: Financial Management and Plan – describes the financial arrangements and risks to implement the project.
 - Chapter J: Procurement Plan – in this chapter the packaging and procurement procedures are discussed.

- Chapter K: Bidding documents – informs about the status of the preparation of the bidding documents.
- Chapter L: Design and Monitoring Framework – analyses the project impact, outcome and expected outputs.

C. Description of the Economy of Uzbekistan and its Growth Prospects

C.1 General Features

31. Uzbekistan is a doubly landlocked country in Central Asia with a land area of 448,978 sq km (172,742 sq mi), a population of 32.4 million (2017) and a GDP of \$49.7 billion, corresponding to a per capita GDP of \$1,504 in 2017 (the GNI based on Purchasing Power Parity – PPP – was estimated at \$230.8 billion, corresponding to a GNI per capita of \$7,130).
32. The country is divided into 12 provinces and the Republic of Karakalpakstan, which represents about a third of the country in land area in the northern part of Uzbekistan. Due to its location within a series of endorheic basins, none of its rivers lead to the sea with the two largest emptying into the Aral Sea. The country is bordered by five countries: Kazakhstan in the north, Tajikistan to the south-east, Kyrgyzstan to the northeast, Afghanistan to the south and Turkmenistan to the southwest.
33. Uzbekistan has a continental climate, with a relatively short winter season and a long growing season with adequate water resources for most part of the country. The average summer temperature tends to be about 40C (104F), while the average winter low temperature is around -23C (-9F).

C.2 Demographics

34. Uzbekistan is Central Asia's most populous country with 32.4 million inhabitants. According to official sources, Uzbeks comprise the majority (83.4%) of the population. Other ethnic groups include Russians, 2.3%, Tajiks, 4.8%, Kazakhs, 2.5%, Karalpaks, 2.2% and Kyrgyz, 0.9%, as well as Koreans and Tartars and many other nationalities, relocated to Uzbekistan in the 1940s.
35. At least 10% of the Uzbekistan's labor force worked abroad around 2010, mainly in Russia and Kazakhstan. This percentage may have since declined due to economic problems in these two countries and strong growth in Uzbekistan.
36. Uzbekistan has a 99.98 % literacy rate in 2015 among adults older than 15, which is attributable to the free and universal education system of the Soviet Union and of the Republic of Uzbekistan after gaining independence.

C.3 Economy

37. Agriculture accounted for about 40% of the country's economic output until the independence in the early 1990s, with cotton representing 40% of this output being the main export crop. Other crops include fruit and vegetables, which are increasing their share (also of exports), cereals, rice, alfalfa, wine grapes, sesame, tobacco and sugar cane. Uzbekistan also produces Karakul sheep pelts. Traditional crafts, such as silk dying and carpet weaving have enjoyed resurgence after independence.
38. With the economy diversifying, agriculture represents about 20% of the GDP in 2017, while the share of industry increasing to 34% of the economy today. The share of services in the economy is about 46%.
39. Uzbekistan is the main producer of machinery and heavy equipment in Central Asia. The country manufactures machines and equipment for cotton cultivation, harvesting and processing and for use in the textile industry, irrigation and road construction. This emphasis on making machinery also makes ferrous and nonferrous metallurgy important. Light industry includes tea-packing plants and factories for garment making.
40. However, Uzbekistan's real strength is its role as a commodity producer and exporter. It was in 2013 the world's seventh-largest producer and fifth-largest exporter of cotton in the world. It has the fourth largest gold deposits in the world. The country mines 80 tons of gold annually, seventh in the world. Uzbekistan's copper deposits rank tenth in the world and its uranium deposits twelfth and production seventh globally (uranium was its single largest export commodity to the U.S.).

41. The Uzbek national gas company, Uzbekneftegas, ranks 11th in the world in natural gas production with an annual production with an annual output of 60 to 70 billion cubic meters (2.1 – 2.5 trillion cubic ft). Its 10 billion cm of export to Russia has declined in the past few years but is being replaced by an equal volume of export of natural gas to China. The country has significant untapped reserves of oil and gas: there are 194 deposits of hydrocarbons in Uzbekistan, including 98 condensate and natural gas deposits and 96 gas condensate deposits. The largest recently discovered deposits are in Karapalkastan, one of the poorest regions in Uzbekistan.
42. As a result of its strength in natural resources and exports, Uzbekistan has been able to maintain a positive foreign trade balance until 2012 and in subsequent years there is a negative foreign trade balance with a deficit of 6.4 billion US Dollars per annum in the last 5 years.
43. Uzbekistan has been one of the fastest growing economies in the world over the past 10 years. GDP growth was 7.9% per annum over the last 10 years. However, GDP growth was lower at 5.3% in 2017 and the estimates indicate a GDP growth in the range from 5 to 6 % in the next 5 years.

C.4 Economic and Traffic Growth Rates

Table 2: Summary of GDP growth rates (based on above), % p.a.

2001	4.2	2011	8.3
2002	4.2	2012	8.2
2003	4.4	2013	8.0
2004	7.7	2014	8.1
2005	7.0	2015	8.0
2006	7.3	2016	7.8
2007	9.5	2017	5.3
2008	9.0	2018	5.0 forecast
2009	8.1	2019	5.1 forecast
2010	8.5	2020-2024	5.5 to 6 estimate

Source: World Development Indicators, The World Bank and IMF forecasts

44. Traffic growth is linked with economic growth. The elasticity vis-à-vis GDP growth varies over time and is dependent on a particular vehicle class/type (for instance, with the development of economy, there is a diversification of the truck fleet, with smaller distribution vehicles and larger, multi-axle trucks used for long distance growing at faster rate than two axle trucks). However, the growth rate for private passenger vehicles and for freight is always a positive number, i.e., the traffic growth exceeds the growth rate for the economy. On the other hand, the growth in bus traffic is normally linked with population growth and may in fact decline as growth in the economy results in increased ownership of cars.
45. The elasticities used in the economic analysis of the Karshi - Kitab road were 1.0 for freight traffic and 1.15 for cars. The elasticity was 0.7 for bus traffic. The elasticity for freight traffic, could be a bit higher, say 1.05-1.10 for other roads in Uzbekistan, while the future elasticity for cars could be a bit lower at 1.05 - 1.10 rather than the 1.15 used, as the private car ownership is unlikely to continue at the high rates experienced during the past few years. This implies the same elasticities for both car and truck traffic.
46. These may be applied to the through traffic (which will consist mainly of exports and imports to/from Kazakhstan and Russia) on the project roads sections of highway A380.
47. In addition, these road sections serve local traffic of Karakalpakstan. Economic growth in this region has been depressed as a result of issues related to utilization of Aral Sea. Future looks, however, more promising. World Bank is funding the large South Karakalpakstan Water Resources Management Improvement Project and there have been major discoveries of natural gas within the republic. These are likely to result in an increase in economic growth as compared with the past more depressed conditions.

D. Environmental Safeguards

D.1 International Environmental Policy

48. Uzbekistan is a party to the following multilateral environmental agreements including those on biodiversity, climate change-Kyoto protocol, desertification, endangered species and hazardous wastes. Those with particular relevance to the project include:
- Convention on International Trade in Endangered Species of Wildlife Fauna and Flora, 1973-03-03
 - Convention on the Conservation of Migratory Species of Wild Animals, 1979-06-23
 - Convention on the Control of Transboundary Movements of Hazardous wastes and their Disposal, 1989-03-22
 - Agreement on Cooperation in the Field of Ecology and Environmental Protection, 1992-02-08
 - United Nations Framework Convention on Climate Change, 1992-05-09
 - Agreement between Government of Republic of Kazakhstan, Government of Kyrgyzstan Republic and Government Republic of Uzbekistan on Cooperation in the Sphere of Biological Diversity Conservation of West Tien Shan, 1998-03-17
 - Agreement on Cooperation in the Area of Environmental Monitoring, 199-01-03
 - Agreement on the Conservation of African-Eurasian Migratory Water birds

D.2 ADB's Safeguard Policy Statement

49. ADB policy requires that an Environmental Impact Assessment (EIA) Report be prepared by the borrower in accordance with ADB EA requirements and that loans or grants are classified according to their potential impact on the environment. Since the proposed project requires re-alignment of sections that will pass through critical wildlife habitat it is classified as Environmental Category A project. Accordingly, the detailed EIA study is being carried out in accordance with the ADB's "A Good Practice Sourcebook, Environment Safeguard, December 2012." The ADB Rapid Environmental Assessment (REA) Checklist for Roads and Highways has been completed for the project.

D.3 Country Environmental Policies, Laws, Regulations and Administrative Framework

D.3.1 Citizen's Constitutional Rights and Responsibilities

50. Uzbekistan has developed numerous laws and regulations over and has updated the old Soviet legislation and policies to pursue sustainable social and economic development. The government is continuously revising and improving the national environmental legislation, enacting new environmental laws and regulations, developed programs and action plans to address environmental issues to promote sustainable use of natural resources.
51. The constitution of Uzbekistan, under its nature protection and management framework define the rights and responsibilities of its citizens to include:
- All citizens shall protect the environment (Article 50)
 - Any property shall not inflict harm to the environment (Article 54)
 - Land, subsoil, flora, fauna, and other natural resources are protected by the state and considered as resources of national wealth subject to sustainable use (Article 55).

D.3.2 Overall legal framework

52. Environmental protection is administered in Uzbekistan by the State Committee of the Republic of Uzbekistan on ecology and environmental protection (SCEEP). SCEEP is the primary environmental regulatory agency reporting directly to the Parliament and responsible for the implementation of the Environmental Protection Law (1992). Based on the Regulation on the State Environmental Committee of the Republic of Uzbekistan (1996), it is responsible for supervising, coordinating and implementing environmental protection. It also controls the use and renewal of natural resources at the central, region and district levels.
53. The overarching legislative framework that establishes the legal framework for environmental protection in the Republic of Uzbekistan is Law No.754-XII, 1992 on nature protection. The law states legal, economic, and organizational bases for the conservation of the environment and the rational use of natural resources. Its purpose is to ensure balanced relations between man and nature, to protect the environmental system and to guarantee the rights of the population to a clean environment. According to the legislation of the Republic of Uzbekistan, the Cabinet of Ministers of Republic of Uzbekistan, SCEEP and the local government bodies are responsible for implementing state laws on environmental protection and management of natural resources. Article 25 of this law requires the State Environmental Expertise (SEE) is a mandatory measure for environmental protection, preceded to decision making process. In addition, Article 25 prohibits the implementation of any project without a positive conclusion of SEE.

D.3.3 Relevant Natural Resource and Environmental Management Laws

54. Uzbekistan has enacted the following natural resources and media-specific environmental management laws:
 - "Nature protection" (1992) provides the basis of the State Environmental Expertise (SEE) as a mandatory measure for environmental protection required for decision-making process. It also prohibits the implementation of any project without a positive conclusion of SEE.
 - "Atmospheric Air Protection" (1996, amended on 10.10.2006). Specified standards, quality and deleterious effect norms, requirements on fuels and lubricants, production and operation of vehicles and other transport means and equipment, ozone layer protection requirements, obligations of enterprises, institutions and organizations toward atmospheric protection, and compensations for damages from atmospheric pollutions.
 - "Water and water use" (1993). Regulates the rational use of water and protects waters from pollution and depletion,
 - "Land Code" (1998). Regulate land use and development by ensuring present and future generations have science-based, sustainable use and conservation of land
 - "Wastes management" (2002, as amended on 2011). Addresses waste management and mandating the SNPC to conduct inspections, coordination, provide ecological expertise and establishing certain parameters for waste management and disposal.
 - "Protected Natural Reserves" (2004) mandates the preservation of unique, valuable natural objects and complexes, genetic fund of plants and animals, the prevention of the negative impacts
 - "Environmental control" (2013). Provides the approach prevention, detection and suppression of violation of the requirements of legislation in the field of environmental protection and rational use of natural resources through monitoring determination of compliance, and ensuring compliance
55. Other national laws and standards applicable to road projects are: i) Law on Protection and Usage Objects of Archeological Heritage (2009); ii) Decree of Cabinet Ministers of Uzbekistan on the procedure of issuing permits for special water use and consumption No. 171 of 14.06.2013; iii) State standard O'z DSt 1057:2004 "Vehicles. Safety requirements for technical conditions" and O'z DSt 1058:2004 "Vehicles. Technical inspection. Method of

control"; iv) SanR&N No.0179-04 Hygienic norms. List of Maximum Allowable Concentrations (MACs) of pollutants in ambient air of communities in the Republic of Uzbekistan; v) SanR&N No. 0267-09 Admissible noise level into the living area, both inside and outside the buildings; vi) SanR&N No.0120-01 Sanitarian Norms of allowed level of noise at the construction sites; vii) SanR&N No 0088-99 Sanitarian requirements for development and approval of maximum allowed discharges (MAD) of pollutants discharged into the water bodies with waste waters.

D.3.4 Air, Water, Noise and Waste Standards and Regulations

D.3.4.1 Air Quality Legislation and Standards

56. The key legislation relating to air emissions and ambient air quality in Uzbekistan applicable to the Project includes the following:
- Law of the Republic of Uzbekistan on Atmospheric Air Protection - No.353-I of 27.12.1996 (as amended on 10.10.2006)
 - Law of the Republic of Uzbekistan on State Sanitary Control - No.657-XII of 03.07.1992 (as amended on 03.09.2010).
 - Criminal Code, Section 4. Environmental Crimes approved on 22.09.1994 (as amended on 04.01.2011).
 - Law of the Republic of Uzbekistan on Environmental Expertise - No.73-II of 25.05.2000 (as amended on 04.01.2011).
57. The key sanitary rules and norms of Uzbekistan include:
- List of Maximum Allowable Concentrations (MACs) of pollutants in ambient air of communities in the Republic of Uzbekistan SanR&N No.0179-04.
 - Sanitary norms and requirements to protect ambient air in communities of the Republic of Uzbekistan SanR&N No.0246-08.
 - List of Maximum allowed concentration (MAC) of pollutants into the atmosphere air of settlements in Uzbekistan SanR&N No 0293-11.
 - List of maximum permissible concentration (MPC)- microorganism-producers in the air of settlement areas SanR&N No 0147-04.

D.3.4.2 Water Quality Legislation and Standards

58. Water resources management, allocation and use in Uzbekistan are under the control of the Ministry of Agriculture and Water Resources (MAWR). It oversees national specialized associations, provincial and district departments of agriculture and water resources, and interprovincial and inter-district canal management authorities. MAWR is responsible for the implementation of the Water and Water Use Law (No.837-XII of 06.05.1993). It monitors the regulation of water use; protection of waters from pollution and depletion; prevention and liquidation of harmful effects of water; and improvement of water bodies and the protection of the rights of enterprises and institutions, organizations and dehqan farms and individuals. This Law authorizes the following concerned agencies to carry out management and control of water use and protection; i) MAWR for surface water; ii) State Committee for Geology and Mineral Resources (Goskomgeologia); and iii) State Inspectorate for Exploration Supervision, Operations Safety Supervision of Industry, Mining and Utilities Sector (or Sanoatgeokontekhnazorat). The key regulations governing water quality are: i) rationalizing discharges of pollutants into water bodies and on the terrain, taking into account technically achievable performance of wastewater treatment (RH 84.3.6:2004), ii) endorsement and approval of projects of wastes disposal and limits for its disposal (RH 84.3.22:2006), iii) hygiene requirements for the protection of surface waters in Uzbekistan's SanR&N No 0172-04 and criteria for hygienic assessment of the level water bodies contamination for health risks population in Uzbekistan (SanR&N No 0255-08); iv) development and approval of maximum allowed discharges (MAD) of pollutants discharged into the water bodies with waste waters (SanR&N No 0088-99).

D.3.4.3 Noise Standards

59. SanPiN 0267-09 provides the noise limits which are consistent with the IFC guide values as follow:

Table 3: Noise Limits from SanPiN No. 0267-09& IFC EHS Guidelines

Location	Time	SanPiN No. 0267-09	IFC Standards (7am – 11pm / 11pm – 7am)
Areas adjacent to homes, clinics, dispensaries, rest homes, boarding houses, boarding homes for the elderly, childcare facilities, schools and other educational institutions, libraries	From 7 am to 11 pm	55 dB(A)	55 dB(A)
	From 11pm to 7 am	45dB(A)	45 dB(A)

D.3.4.4 Other Regulations Relating to Road Construction

60. The following section provides a summary of other regulations relating to road construction in Uzbekistan:
- Uzbek Law on Automobile Roads (July 03, 1992) states that any construction or reconstruction of roads requires the official approval of the Ecological Committee.
 - Law on Protection of Archeological Monuments (October 13, 2009). Regulation of the relations in the range of protection and use of cultural heritage objects which is national property of Uzbek people.
 - ShNK 2.05.02 – 07; KMK 2.05.03-97 Building Code & Regulations for Automobile Roads Environmental Protection.
 - The Law of the Republic of Uzbekistan on Sanitary and Epidemiological Safety, 1995 Section III: Responsibilities of State Bodies, Agencies, Companies on the Provision of Sanitary and Epidemiological Safety.
 - ShNK 3.06.03 – 08; KMK 3.06.04-97 Norms of Construction Safety.
 - Guidelines for Road Construction, Management and Design, Part I: Planning of Automobile Roads: Addresses environmental issues in road design, construction and maintenance. Part II: Construction of Automobile Roads: Requires that the impacts on the ecological, geological, hydro-geological and other ecological conditions are minimized by implementing adequate protective measures. Part III: Protection of the Environment.
 - KMK 2.01.08-96; ShNK 2.07.01-03; KMK 2.10.09-97 Regulations on Environmental Protection in Construction, Rehabilitation and Maintenance of Roads.

D.4 Environmental Impact Assessment

61. The Law on Ecological Expertise (2000) and Decree of the Cabinet of Ministers No 491.31.12.2001 establish the Government environmental impact assessment system requiring the SEE Department (Glavgosekoexpertiza) to reviews environmental impact reports, among others. The review of environmental assessment is based on: i) compliance of projected economic and other activities with environmental requirements in the stages preceding decision making on its implementation; ii) level of ecological danger planned or carried out business and other activities, which may have or had a negative impact on the condition of the environment and public health; and iii) adequacy and reasonableness of the measures provided for the protection of the environment and rational use of natural resources.

62. All economic activities subject to SEE are classified into one of four categories based on potential environmental impacts as follows: i) Category I –Corresponds to ADB category A; ii) Category II –Corresponds to ADB category B; iii) Category III –Corresponds to ADB category B or C; and iv) Category IV - Corresponds to ADB category C.¹
63. The state environmental review is conducted by the Main Directorate for State Ecological Expertise (Glavgoosecoexpertiza) of SCEEP. State environmental expertise of the Republic of Karakalpakstan, Provinces and Tashkent city implements state environmental expertise. Depending on the project classification the review of the environmental assessment follows 3 stages: i) Stage 1: Draft Statement on Environmental Impacts (DSEI) ('PZVOS' is the national acronym) to be conducted at the planning stage of the proposed project prior to development funds being allocated. ii) Stage 2: Statement on Environmental Impact (SEI) ('ZVOS' is the national acronym) to be prepared as required by the Glavgoosecoexpertiza at Stage I to include additional investigations or analyses as necessary. The Statement must be submitted to the Glavgoosecoexpertiza before approval of the project's feasibility study, and therefore before construction; and iii) Stage 3: Statement on Environmental Consequences (SEC) ('ZEP' is the national acronym) represents the final stage in the SEE process to be completed before the project is commissioned. During this stage, the Goskompriroda at the state and oblast levels, defines the pollution limits of the project. Uzbekistan prescribes the maximum review period for Goskompriroda as 30 days review for Category I and II projects and 20 days for category III and 10 days for Category IV projects.
64. The proposed Karakalpakstan Road Project has already been subject to ZVOS and relevant approvals have been given by Glavgoosecoexpertiza of SCEEP.
65. As a result of the biodiversity screening of SHELADIA team it turned out, that endangered species are likely to be found in the project area. Further investigations confirmed their existence. Thus, according to ADB SPS the project is categorized as A with regard to environment. The environmental impact assessment (EIA) is being carried out and a Draft EIA report has been prepared. The EIA report includes the EMP and the initial biodiversity impact assessment. It forms an appendix to the document in hand. Subsequent to the review of Draft EIA, ADB decided to undertake a more detailed ecological study to update the biodiversity assessment and on completion of that study, the Draft EIA will be updated based on the results of the updated biodiversity assessment in the final report.

D.5 Administrative Framework

66. As stated above, Environmental protection is administered in Uzbekistan by the SCEEP which consists of a central body in Tashkent, and regional and district branches and agencies for scientific and technical support. SCEEP, through Glavgoosecoexpertiza reviews, inter alia; environmental impact reports, prepares and implements ecological regulations and standards, coordinates environmental programs and elaborates the structure for environmental monitoring and governance of nature reserves. It approves regulations and issues permits for pollutant emissions and may prohibit projects and construction works that do not comply with environmental legislation.
67. The other State bodies within the Uzbekistan administrative framework with relevant environmental responsibilities are as follows:
 - Ministry of Agriculture (MoA)
 - Ministry of Water Resources (MWR)
 - State Committee for Land Resources, Surveys, Cartography and the State Cadastre (or Goskomgeodezkadastr)
 - State Committee for Geology and Mineral Resources (or Goskomgeologia)
 - Centre of Hydro-meteorological Service (or Uzhidromet)
 - Ministry of Health (or MH)

¹ Based on the report "Uzbekistan Regional Roads and Development Project (P146334) Environmental and Social Management Framework" World Bank, March, 2015. Note – the WB and ADB EIA categories are broadly the same.

- State Inspectorate for Exploration Supervision, Operations Safety Supervision of Industry, Mining and Utilities Sector (or Sanoatgeokontekhnazorat)
 - Ministry of Internal Affairs (or MVD).
68. In 2017, the Government has instituted reforms to rationalize the bureaucratic arrangement for more effective environmental management. The State Nature Protection Committee tasked to supervise inter-agency activities on natural resources protection and use was reorganized to form the State Committee for Ecology and Environmental protection by virtue of Presidential Resolution No. 5024 'On Improving the System of State Management in the sphere of Ecology and Environmental Protection'. The newly organized Committee was strengthened to improve the environmental quality, pollution control, and further improve domestic waste management including treatment and disposal.
69. The same Resolution re-named provincial committees into departments and organizing the Inspectorate for Control of Wastes Generation, Collection, Transportation, Utilization, Treatment, Disposal and Sales Department at the central and provincial levels. It introduced unitary enterprises named 'Toza Hudud' (clean area) under the Committee of the Republic of Karakalpakstan and provincial departments to transport domestic wastes under the district administration. Other reforms included the reorganization of the 'Republican Inspectorate for Protection of Wild Animals and Plants and their Rational Usage' to the 'Inspectorate for Control of Biodiversity Protection and its Usage, and Protected Natural Areas' under the State Committee for Ecology and Environmental Protection, the re-formation of the State Committee for Ecology and Environmental Protection (SCEEP) as the primary environmental regulator with regional branches and agencies providing scientific and technical support with similar structure as the Central.

D.6 Anticipated Impacts

70. The scope of works under Tranche 3 involves rehabilitation and upgrading to 2 lanes with shoulder of the existing Road A380 Karakalpakstan km. 964 to 1,204 passing through Jasliq and Karakalpakstan. The project improvement is a mixture of realignment and existing alignment. Most of the impacts are co-terminus with the construction stage, site specific, limited within the RoW, and are easily mitigated through good engineering and housekeeping practices. All site preparation works, excavation works, particularly at quarrying sites, will generate potential impacts that are local, temporary, and reversible. Potential significant environmental impacts identified during construction stage are the loss of productive soil from new borrow areas, dust emissions, generation of wastes, improper management of borrow areas, and inadequate clean-up operation, restoration and rehabilitation prior to decommissioning. Precautionary measures are sufficiently described in the EMP.
71. Although The entire stretch is outside any legally protected areas. However, the project area is a known habitat of critically endangered species. The proposed project is classified as environment Category A in accordance with the ADB's SPS 2009. Secondary data review of the biodiversity indicated that 2 reptile, 29 birds, and 5 mammal of threatened species based on IUCN and Uzbekistan Red Book inhabit the Ustyurt plateau may be found in the project area.

D.6.1 Preliminary Biodiversity Impact Assessment

72. The initial identification the biodiversity of the project site the project was undertaken using the Integrated Biodiversity Assessment Tool (iBAT) as required by the ADB. iBAT was developed by the Bird Life International, Conservation International, International Union for the Conservation of Nature (IUCN), and UN Environment World Conservation Monitoring Centre (UNEP-WCMC). iBAT is a screening tool that allowed the identification of threatened species in the project area based on an array of databases that includes the: IUCN Red List of Threatened Species, Key Biodiversity Areas (priority sites for conservation) and Protected Planet/The World Database on Protected Areas (covering nationally and internationally

- recognized sites, including IUCN management categories I–VI, Ramsar Wetlands of International Importance and World Heritage sites)².
73. Through iBAT, the project road was identified to be located in 2 grid cells namely; 66001 and 66082. Within these cells, a total of 17 threatened species are likely to be found of which 11 are birds, 1 fish, 1 invertebrate, and 4 mammals which indicates the project area maybe a critical habitat and need particular attention in the conduct of the environmental assessment.
74. Secondary data review of the biodiversity indicated that 2 reptile, 29 birds, and 5 mammal of threatened species based on IUCN and Uzbekistan Red Book inhabit the Ustyurt plateau may be found in the project area. The analysis of fauna representatives and landscape properties of the project are indicated the following:
- The A-380 highway is an important element in migration for almost all species of birds observed. Gulls, Starlings and Larks move to the North almost along the road, since they find food or water in its vicinity. Birds of prey are attracted by the increased number of food objects – rodents along the mound. Some rodents and reptiles die under the wheels of vehicles and thus, become affordable food for birds of prey and gulls.
 - Terrain irregularities of the clay desert of Ustyurt plateau allows the accumulation and preservation of moisture in dry periods, protection from flooding and snow drifts in the period of abundant rainfall, favorable conditions for burrows and good view. Such features make the mound of the project road, quarries and mounds over gas pipelines as attractive for common species of rodents: Large Souslik, Great Gerbil and Libyan Jird. These rodents and animal road kills attract birds of prey and mammals on the carriageway and increases risk of death and injury from vehicular collision.
 - About 10 km North-West of the village Zhaslyk (point No. 6) where the project road passes through a well-preserved Haloxylon forest, which is about 5 km long and 1 km wide. According to our observations, this is the only Haloxylon forest remained throughout the entire road alignment and should be preserved to the extent possible.
 - The power transmission line running north-east almost parallel to the road for 2 km, and in several points cross the road provide a good roosting area and nesting area for birds of prey being attracted by the abundance of rodents along the road which increases to risk of injury and mortality.
 - The existing road embankment is littered with solid household waste - plastic bottles and used plastic bags. This garbage is carried by wind over long distances, entangled in the bushes and disrupts the view of the natural landscape. Plastic bags can scare rare birds who stop to rest during migration. Food waste contained among the garbage can contribute to an increase in the number of rodents and attract land-based predators to the embankment of the highway, creating the threat of death for motor vehicles for them. Some species (steppe turtles, feathered predators, small passerines, etc.) may become entangled in plastic waste, using them to build nests.
75. A screening of the threatened species based on the desk review, public and expert consultations, use of the Integrated Biodiversity Assessment Tool, and field study allowed the identification of 17 priority biodiversity values that were subjected to a preliminary biodiversity impact assessment. These priority species are as follow:
- *Agrionemys horsfieldii* (Gray, 1844), Central Asian tortoise, VU (IUCN)
 - *Elaphe sauromates* (Pallas, [1814]), Blotched snake, VU:R (Uz RDB)
 - *Falco cherrug* (J.E. Gray, 1834), Saker Falcon, EN (IUCN) NT (Uz RDB)
 - *Falco peregrinoides* (Temminck, 1829) Barbary Falcon VU:R (Uz RDB)
 - *Neophron percnopterus* (Linnaeus, 1758), Egyptian Vulture, EN (IUCN)
 - *Circus gallicus* (J.F. Gmelin, 1788), Short-toed Snake-eagle/Short-toed Eagle, VU:D (Uz RDB)
 - *Aquila nipalensis* (Hodgson, 1833), Steppe Eagle, EN (IUCN), NT (Uz RDB)
 - *Aquila heliaca* (Savigny, 1809), Eastern Imperial Eagle, VU (IUCN), VU:D (Uz RDB)
 - *Aquila chrysaetos* (Linnaeus, 1758), Golden Eagle, VU:R (Uz RDB)
 - *Chettusia gregaria* (Pallas, 1771), Sociable Lapwing, CR (IUCN), VU:R (Uz RDB)

² <https://www.iucn.org/theme/business-and-biodiversity/our-work/business-approaches-and-tools/integrated-biodiversity-assessment-tool-ibat-business>

- *Larus ichthyaetus* (Pallas, 1773), Great Black-headed Gull / Pallas's Gull, VU:R (Uz RDB)
 - *Vormela peregusna* (Guldenstaedt, 1770), Marbled Polecat, VU (IUCN)
 - *Caracal caracal* (Schreber, 1776), Caracal, CR (UZ RDB)
 - *Mustela eversmanni* Lesson, 1827, Steppe polecat, (VU, IUCN)
 - *Saiga tatarica* (Linnaeus, 1758), Saiga Antelope, or Saiga, CR (IUCN), CR (Uz RDB)
 - *Vulpes corsac*, Corsac Fox, VU (UZ RDB)
 - *Felis margarita* (Loche, 1858), Sand Cat, NT (Uz RDB)
76. Risk levels posed by the project was initially assessed for the identified priority species based on the IUCN impact of consequence and the likelihood of occurrence. Of the 17 priority biodiversity values high levels of risk were assessed for the raptors that includes: Saker Falcon, Barbary Falcon, Egyptian Vulture, Short-toed Snake-eagle/Short-toed Eagle, Steppe Eagle, Eastern Imperial Eagle, and Golden Eagle. Also considered at high risk from the project are the Sociable Lapwing, and Great Black-headed Gull / Pallas's Gull. The project poses direct mortality impacts as the raptors and Pallas's Gull forage on road kills and prey on the large rodent population along the project road which increases the risk of vehicular crashes. The Sociable Lapwing's behavior of being gregarious are at risk of being killed by guard dogs usually employed by the contractors to secure the camp sites.
77. A more detailed biodiversity survey and critical biodiversity area assessment is currently being conducted in order to generate critical information on specific species location, population, and behavior.

D.7 Public consultations

78. First level consultations were organized on March 20-21, 2019. Due to the peculiar road alignment and very sparse population, a single consultation meeting is not feasible nor recommended to demonstrate meaningful consultation as this will restrict participation of key stakeholders due to transportation cost. Separate consultations were organized in Jaslik on 20.03.2019 namely in Mahalaya, Women's committee, Kindergarten school, and Gas Company with 17, 24, 4, and 5 participants majority of which were women. The consultations were undertaken to:
- Advise communities of updated project information on the proposed road upgrade project in respect of the section from A- 380 Km. 964 to km1,204;
 - Disclose the preliminary findings of the EIA and EMP, more particularly the biodiversity aspect;
 - Engineering details for the road, prospected schedules, expected benefits and anticipated impacts, including proposed mitigation measures. It was also disclosed that there will be a mechanism in place where local citizens and stakeholders affected will have a chance to forward their concerns, complaints at specified offices, and advance compensation claims for lost assets or business opportunities, as applicable.
 - Seek comments from community on any further environmental concerns associated with the project
79. Ninety-nine people participated in the consultation including from Jaslik and Karakalpakstan representing Womens' Committee, Gas Company Employees, Teachers, and village representatives. No concerns have been forwarded with respect to environmental impacts or competitive issues affecting the local resources or the social setting despite of a detailed discussion on the biodiversity was conducted, covering the threatened species that were identified in the project area. The participants shared the hope that this Project will not only result in improving the livelihood of many residents but will also bring job opportunities to the region which is marred with high rates of unemployment and lack of business.
80. A second-round of consultation in the same villages and a second-level consultation involving national and international stakeholders will be organized prior to the completion of the detailed biodiversity assessment to present its findings in recommendations.

D.8 Grievance Redress Mechanism

81. The Grievance Redress Mechanism (GRM) is available to people living or working in the areas impacted by the project activities. Any person impacted by or concerned about the project

- activities has the right to participate in the GRM, should have the easy access to it, and be encouraged to use it. The proposed GRM does not replace the public mechanisms of complaint and conflict resolution envisaged by the legal system of the GoU, but attempts to minimize use of it to the extent possible.
82. Overall responsibility for timely implementation of GRM lies with the RFF through its PMU supported by the Engineer involved in managing and supervising the civil works, while the Contractor undertakes the actual civil works. Relevant Khokimyats, who are mandated by law to perform grievance redress related tasks, and mediators who are involved in facilitating amicable resolution of grievances are also included in GRM.
83. This GRM envisages two levels of grievance resolution for the road sector projects implemented under the supervision of the PMU: Grievance Redress Committees (GRC) at the local level and central (Tashkent) level. Local GRCs are composed of members nominated from the PMU, Khokimyats, Engineer & Contractor. GRCs at the central levels are chaired by the Heads responsible for the overall operation of GRM and its efficient and timely implementation, while the Coordinators are responsible for involving the relevant parties and coordinating the works of GRCs at regional/central levels.
84. In addition to the GRM, the ADB has also developed its Accountability Mechanism (AM) Policy. The AM provides a forum where people adversely affected by ADB-assisted projects can voice and seek solutions to their problems and report alleged noncompliance with ADB's operational policies and procedures. It consists of two separate but complementary functions: problem solving function and compliance review function. The objective of the Accountability Mechanism Policy 2012 is to be accountable to people for ADB-assisted projects as a last resort mechanism.

D.9 Environmental Management Plan

85. The EMP contains the agreements between the RRF and the ADB on the implementation of mitigation measures, monitoring program, cost estimates, and institutional arrangement to ensure that no significant adverse impacts results from the project intervention. The EMP will be revised accordingly based on the findings and recommendation of the biodiversity assessment. There are 2 types of environmental management plans (EMP) to be used in this project, a general management that is provided in this report that provides summary information on the types of impacts, required mitigation and monitoring measures, and implementation arrangements including reporting requirements. The second type of EMP is the site-specific EMPs (SSEMP) the Contractor will prepare in consultation with the Construction Supervision Engineer and Environmental Specialist. The SSEMP describes the precise location of the required mitigation and monitoring, persons responsible, and the schedule and reporting methodology. The SSEMPs will be submitted to the PMU for approval at least 10 days before taking possession of any work site. No access to the site will be allowed until the SSEMPs are approved by the PMU.
86. The mitigation measures to address the high level risks initially identified on the biodiversity are easily designed and readily implemented by the project which includes the protection of the well-preserved Haloxylon forest, solid waste management to avoid attracting these species that will expose them to unsafe environment, technical design of the electric lines, education of contractors, rodent control, and continuous assessment and monitoring particularly during construction. Upon effective implementation of the mitigation measures it is anticipated that no residual adverse impacts, or likelihood of such, on the critical habitat which could impair its high biodiversity value or the ability to function will take place. Based on preliminary biodiversity assessment, the project is not anticipated to lead to a reduction in the population of any of the priority biodiversity values identified in the project that will compromise its viability.
87. Other impacts are typical of any road construction and are also easily mitigated. All site preparation works, excavation works, particularly at quarrying sites, will generate potential impacts that are local, temporary, and reversible. Potential significant environmental impacts identified during construction stage are the loss of productive soil from new borrow areas, dust emissions, generation of wastes, improper management of borrow areas, and inadequate clean-up operation, restoration and rehabilitation prior to decommissioning. Precautionary measures are sufficiently described in the EMP. Emissions from vehicle movements and speeding will be of local concern, near human settlements near the

bypasses. However, in most localities the annual wind conditions are suited to carry exhaust and other emission gases away from human settlements before any public health concern would arise. The EMP addresses problems associated dust and provides many mitigation solutions. Other impacts associated with supporting facilities for construction works such as problem associated with construction worker have been addressed also in the EMP. None of the identified impacts are appraised to have unmanageable dimensions.

88. Site EMPs will be prepared by the contractor subject to be reviewed and approved by the RRF before the commencement of construction. Meaningful consultations have been conducted during the project preparation stage and all concerns of the affected persons and stakeholders have been incorporated in this EIA and the EMPs. These consultations were represented by key environmental agencies, roadside communities, and non-government organizations. An integrated social and environmental Grievance Redress Mechanism has been formed to continue receiving feedback and complaints, if any, from affected parties and addressing them during the construction stage and operation stage. This EIA report is disclosed on the ADB and RRF websites.
89. Environmental Provisions in Bid and Contract Documents. Specific environmental provisions are recommended for inclusion in the bid and contract documents including provisions related but not limited to: a. biodiversity protection, b. location of construction camps and other facilities (not in environmentally sensitive areas or close to settlements), c. borrow pit restoration, d. safety provisions, e. baseline and routine monitoring of air quality around quarries, and f. local communities relations.
90. Environmental Monitoring and Control. Baseline and routine noise, vibration, and air quality monitoring is recommended in project area.
91. Capacity Building for Environmental Management. Training program for selected staff and addressed to the goals and techniques of environmental management activities in road projects is recommended.

E. Social Safeguards

E.1 The Project

92. Identified by the Republic of Uzbekistan as part of the priority road development program³, the Karakalpakstan Road Project involves rehabilitation/construction of the 240km long Kungrad to Daut-Ata section of the Guzar-Bukhara-Nukus-Beyneu highway (A380) from km 964 to km 1204 connecting to the Kazakh border. Further, along with the improvements proposed in A380, two weigh-in-Motion (WIM) facilities have been proposed at km 2.7 in road A373 and at km 817.9 in road M39, and improvements to an existing WIM at km 192.4 in road A373. The Committee for Roads of Uzbekistan, which is mandated to undertake improvement and upgradation of various roads at different locations in the Republic of Uzbekistan will be the executing agency.
93. The existing road will be upgraded to a two-lane road with shoulders and with cement concrete pavement. The project road follows the existing A-380 from kilometrage 0.000 to about 9.207 and then re-aligns to the left from until 79.000 with a maximum separation distance of almost 4.6 kms. Between km 79.000 and 119.00 the project alignment again follows the existing A380. The project alignment then runs parallel on the left hand side to the existing road until 109.000 km at a distance of about 35 m. The separation distance increases to about 850 m from 109.000 to 219.000 km and from there joins the existing road alignment to Kazakhstan. Of the total 240 km project road, 61.5 km or 25 percent will follow the existing alignment while the rest will be a realigned new road.
94. The Weigh-in-Motion (WIM) facility proposed at km 2.7 in road A373 (near Rohat Post) and at km 817.9 in road M39 (near Erkin Post) envisages the design, supply and installation of WIM systems to allow the collection of axle load data and implement enforcement against overloading to protect the accelerated deterioration of transportation infrastructure. These two facilities proposed will enable the Committee for Roads to: (i) implement axle load control data collection process that provide the required data to the specified accuracy; (ii) implement enforcement process, using data collected, against overloaded vehicles owners and drivers; and (iii) develop a WIM system team within a wider intelligent transportation system group who can successfully manage Axle Load Control and enforcement process.

E.2 Profile of the Project Area

95. The project road (A380) lies entirely within the District of Kungrad, Republic of Karakalpakstan and provides connectivity to two major settlements viz. Jasliq and Karakalpakiya. Both these settlements are away from the project road which passes along uninhabited barren land.
96. The Republic of Karakalpakstan is located in the north-western part of Uzbekistan, in the lower reaches of the Amu Darya, on the southern coast of the Aral Sea. The south-western part of the Republic adjoins the Karakum Desert. In the north-west is the Ustyurt lowland, and in the north-eastern part - the Kyzylkum desert. The southern part of the Aral Sea is located in the territory of Karakalpakstan. The total area of Karakalpakstan is 166.6 thousand sq.km and by the size of the territory it occupies the first place among the regions of the Republic of Uzbekistan, making up approximately 37 percent of the overall size of the Uzbekistan territory and having a population of 1,881,900 persons, accounting for 5.6 percent of the population of the Republic of Uzbekistan. It borders with Khorezm, Navoi and Bukhara regions. The capital of the Republic of Karakalpakstan is the city of Nukus.
97. The district of Kungrad consists of 1 city (i.e.) Kungrad, 21 makhallas (local communities), 5 urban settlements, and 12 Rural Communities Citizens Centers. Kungrad district spreads over an area of 76 thousand km², is one of the biggest districts in the republic and constitutes 12 percent of Uzbekistan's territory and 46 percent of Karakalpakstan's territory. The population⁴ is 128.3 thousand people and comprises of 80.9 thousand people (63%) living in urban areas and 47.4 thousand people (37%) in rural areas. The total employed is 52,580 residents, with

³ Resolution of the President of the Republic of Uzbekistan No 2313 on the Program of Development and Modernization of the Engineering-Communication and Road and Transport Infrastructure for the period 2015-2019, dated 06 March 2015

⁴ As on 01 January 2019, State Committee of the Republic of Uzbekistan on Statistics

42 percent employed in formal sector and 58 percent employed in informal sectors. The level of unemployment is 10 percent and the average salary is 2,017,800 UZS.

E.3 Subproject Impacts

98. Road network is a key element of the economy of the Republic of Uzbekistan. Its effective functioning and sustainable development are important for its economic growth, integrity and national security, as well as to improve living standards and livelihoods. Roads are an essential part of the transport infrastructure. The share of road transport accounts for 89.2 percent of the volume of freight traffic. On average, vehicle fleet increased by 7 - 10 percent annually in the country. Also, there is a steady increase in long-distance journeys. The primary economic benefits of the investment program are cost savings from vehicle operation, reduction in travel time, and lower transaction costs related to transportation. Other benefits are: i) the establishment of international transport corridors, ii) improvements in road transport efficiency, iii) increase in freight and passenger transport due to improvements in the quality of roads, iv) increase axle load capacity to 13 tons, and v) less road crashes due to improvements in road safety.
99. The western part of the region is rich in natural resources such as marble, gypsum, salt, oil, gas and other large natural resources. Shakhpakhta, Quvanish, Aqsholak, Ush-Say, Urga are the main gas fields. Urga Káni is part of the gas pipeline built in 1995 and has been supplying gas to the country. Finally, salt valley "Barsa gemes" length is 75 km, width is 70-72 km, 30-60 m high and 1000 m² capacity. It consists from 10 billion pounds of salt. In order to use resources, the Government of the Republic of Uzbekistan approved the #79th Decree of the Cabinet of Ministers on March 2, 1995, and established the Kungrad soda plant. Amudarya is the main water source of the RK. "Suvenli" and "Rawshan" channels are the additional irrigation channels.
100. The reconstruction of the road will not only generate temporary employment and permit more efficient movement of mining and new industrial products, but also enable faster and more efficient international trade with the neighboring countries, Russia, China and Europe.
101. The settlements in the project area that are located away from the project road would have improved connectivity with major trading, educational and administrative centres. Further, the improved road will reduce the travel time to the residents of the settlements along this road, to work place, hospitals and markets. Better connectivity to the district headquarters and to the border of Kazakhstan will lead to industrial growth along the project road that will result in employment generation. However, the project will require land under private use and removal of a structure for improving the road, resulting in negative impact to two families.
102. The project involves acquisition of land under private use measuring 0.0613 ha belonging to 1 owner, acquisition of 311.62 ha of valley and other land plots not used in agriculture, 1.5 ha of valley and other land plots for construction of training centres at Jasliq and Karakalpakiya and temporary acquisition of 915.77 ha of valley and other land plots not used in agriculture, all for the A380 road project and the proposed training centres. All land required for the project are owned by the State. These lands are barren and uncultivable due to the low soil fertility and absence of irrigation. In addition, the proposed two new WIM facilities will involve use of 1.67 ha of land, which is currently managed by Uzavtyoul regional department, a unit of the Committee for Roads, being land parcels abetting the highway and free from encumbrance.
103. The acquisition of land will cause economic displacement to 2 families, comprising of 1 structure owner who would be losing the rental income derived from the commercial building that will be affected and 1 tenant who is having a restaurant in the affected commercial building. Further, 1 motel-owner will face non-significant impact by way of temporary disruption during shifting of water and gas supply pipeline to his motel as part of utility shifting. The shifting of the water and gas supply pipeline is in the scope of the contractor as part of the utility shifting and will be completed prior to commencement of civil works and the Project Implementation Unit (PIU) established at Kungrad will ensure that there is no disruption to the business activity during the shifting of utility. In the event of any disruption to the business activity during the utility shifting, the impact will be mitigated in accordance with the involuntary resettlement safeguard principles of this LARP. There is no impact to common property resource in this project. Altogether the project will cause impact to 2 families and temporary disruption to 1 family. In addition, two of the proposed new WIM facilities will involve use of 1.67 ha of land, which is currently managed by Uzavtyoul regional department, a unit of the

Committee for Roads, being land parcels abetting the highway and free from encumbrance. The improvements proposed for the third existing WIM facility involves only installation of equipment within the available facility.

104. The census and socio-economic survey and consultations held along the project area confirm that there are no indigenous people in the settlements along the project road and further the project does not impact any indigenous people's communities.

E.4 Scope and Objective of Resettlement Plan

105. The Committee for Roads (CR) has prepared a resettlement plan based on the final and detailed design for the 240 km long Kungrad to Daut-Ata section of A380, proposed under Third CAREC Corridor Road Investment Program and the proposed three weigh-in-Motion (WIM) facilities. The objective of the resettlement plan is to assist the affected people to improve or at least restore their living standards to the pre-project level. The LARP describes the magnitude of impact, mitigation measures proposed, method of compensating for land, structure and other assets, eligibility criteria for availing rehabilitation and resettlement assistances, baseline socio-economic characteristics, entitlements based on type of loss and tenure, the institutional arrangement for delivering the entitlements and mechanism for resolving grievances, monitoring and is in compliance with ADB's Safeguard Policy Statement, 2009 and legislations of Republic of Uzbekistan.

E.5 Policy and Legal Framework

106. Recognizing the social issues that can arise in road projects, the Republic of Uzbekistan has passed many Resolutions to align the National Legislation with the safeguard's requirement of multilateral agencies. The policy framework for this project is based on Land Code of the Republic of Uzbekistan, 1998, Housing Code of Republic of Uzbekistan, 1998, Civil Code of Republic of Uzbekistan, 1995, Labor Code and Employment Law, Law on Automobile Roads, the various Resolutions of Cabinet Ministers and ADB Safeguards Policy Statement.
107. An Entitlement Matrix has been developed, that summarizes the types of losses and the corresponding nature and scope of entitlements; and is in compliance with legislations of Republic of Uzbekistan and ADB SPS

E.6 Resettlement Budget

108. The resettlement cost estimate for the project road Kungrad to Daut-Ata section of A380 proposed under Third CAREC Corridor Road Investment Program, include compensation payable to Republic of Karakalpakstan for the land being withdrawn/redeemed by the government and valley and other land plots not used in agriculture, determined by the Kungrad District Khokimiyat in accordance with the Land Code of Republic of Uzbekistan.
109. The compensation for structures is at replacement cost (market value) without depreciation, resettlement and rehabilitation assistances to owners (titleholders) in accordance with the legislations of the Republic of Uzbekistan and to non-titleholders in accordance with the provisions of the entitlement matrix of the LARP and cost of RP implementation. The total resettlement cost for the project is 907.09 million UZS. The major heads of budget items are listed below.
110. The compensation for land has been calculated by the Kungrad District Khokimiyat in accordance with Article 6, 20, 23, 36 and 87 of the Land Code of Republic of Uzbekistan, based on the request letter from Road Design Bureau, LLS, General Design Institute⁵ (Appendix 8 to the LARP) and approved vide a Resolution of Khokim of Kungrad District. An amount of 71,121,120 UZS is payable to the Department of Land Resources and State Cadaster of the Republic of Karakalpakstan towards the land cost.
111. The compensation for structures has been arrived at based on the market rate arrived at by Department of Land Resources and State Cadaster, Kungrad District of the Republic of Karakalpakstan for building works, material and labor. For budgetary purpose, the replacement cost for structure without depreciation has been taken as 6,000,000 UZS per

⁵ Letter No.1641/11 from Road Design Bureau, LLS, General Design Institute, dated 31.10.2016

square meter. However, detailed valuation will be done by the department prior to making payment and the valuation report, if any, received from the affected person obtained from an independent valuer will also be considered. Both the valuation reports will be placed before the commission constituted with the deputy Khokim of the district as its head for finalizing the market value of the affected building and if the independent valuer report provides for higher compensation than that of the department valuation, then the independent valuer report will be considered for payment of compensation, after due scrutiny.

112. The rehabilitation and resettlement assistances that are based on monthly minimum wages is as per the November 2018 order of the President of Republic of Uzbekistan, "About increase of wages, pensions, stipends and social allowances". The minimum wages stipulated vide the order is 202,730 UZS. With regard to loss of rental income, the actual rental received has been adopted.
113. The Ministry of Finance of Uzbekistan will provide adequate budget for all land acquisition compensation, rehabilitation and resettlement assistances and resettlement plan implementation costs as budgetary allocation. The funds as estimated in the budget for a financial year and additional fund required based on revised estimates, shall be available at the disposal of the Project Director, Project Management Unit, Committee for Roads, at the beginning of the financial year. The PD, PMU, being the executing agency for this project, will provide necessary funds for compensation for land and structure and the cost of resettlement assistances in a timely manner to the Kungrad District Khokimiyat. The PMU will ensure timely availability of funds for smooth implementation of the resettlement plan. The PIU (Kungrad unit of the PMU, Committee for Roads), will facilitate disbursements through the Kungrad District Khokimiyat, but the responsibility of ensuring full and timely payment to displaced persons will be that of PMU.

E.7 Grievance Redressal Mechanism

114. Grievance Redressal Committee (GRC) will be established at two-levels, one at the Project Implementation Unit (PIU) level and second at PMU level. The GRC will be in place immediately after the project is approved. The GRC will receive, evaluate and facilitate the resolution of affected persons concerns, complaints and grievances.
115. GRC will provide an opportunity to the affected persons to have their grievances redressed prior to approaching the Court of Law. GRC is aimed to provide a trusted way to voice and resolve concerns linked to the project and to be an effective way to address affected persons concerns without allowing it to escalate resulting in delays in project implementation.
116. First level GRC will be a single contact point with the jurisdictional Road Engineer, PIU, Kungrad and the Khokim of Kungrad District. Aggrieved persons can contact either of them and they will be responsible for receiving, hearing and resolving the grievances. Second level GRC will be a 3-member committee at PMU, chaired by Project Director, PMU, Safeguards Officer, PMU acting as its member secretary and the Road Engineer, PMU.
117. In addition to the project level grievance redressal mechanism, affected persons can submit their grievances through the Virtual reception of the President of the Republic of Uzbekistan, that contributes to the unquestioning implementation of the constitutional rights of citizens to appeal to the President of the Republic of Uzbekistan. Through this information system, any persons can send their applications, suggestions and complaints to the President of the Republic of Uzbekistan.
118. The Law of the Republic of Uzbekistan on the Appeals of Individuals and Legal Entities was introduced on 29 October 2014 and this law replaced the earlier law on Appeal of Citizens that was introduced on 13 December 2012. This law guarantees the right to appeal and prescribes the requirements of an appeal, its form and structure. Further, the timeline for addressing the appeal, the procedure for personal hearing, need for maintaining record of appeals and procedure for second appeal are prescribed.

E.8 Institutional Arrangement

119. The Project Director, Project Management Unit, Committee for Roads, will be overall in charge of coordination between the Project Implementation Unit (PIU) and the Khokimiyat of Kungrad District for social safeguards compliance. The officer designated as Social Safeguards Officer

(SSO) at the PMU level will be responsible for assisting Project Director, the PIU and the Kungrad Khokimiyat in the resettlement plan implementation and ensure that project complies with the involuntary resettlement safeguard principles of the resettlement plan.

120. There will be a PIU established at Kungrad by the Committee for Roads and will be under the direct control of the Project Director, PMU. The PIU will be responsible for the implementation of the project and the jurisdictional road engineer will be vested with the responsibility of overseeing the implementation of the resettlement plan with the assistance of the Kungrad Khokimiyat.
121. The project supervision consultant (PSC) will assist PMU to monitor the implementation of safeguards in accordance with ADB's Safeguard Policy Statement (2009). PSC will have a safeguard specialist (social and gender) who will be responsible to ensure that implementation of the Resettlement Plan is in accordance with ADB's Safeguard Policy Statement (SPS) (2009) and other related policies such as the Public Communications Policy (2011). Specifically, the specialist will ensure that PMU hands over sites to the contractor only after affected persons have received compensation and assistances. The specialist will provide monthly and quarterly reports to Project Director, PMU on resettlement implementation. The specialist will be responsible for providing training on safeguards to the officials of PMU, PIU and the Khokimiyat and Cadastral department of Kungrad District.

E.9 Poverty and Social Assessment

122. The Poverty and social assessment study was conducted in a participatory manner involving the community of Jasliq and Karakalpakiya. Consultations were held with all major stakeholders in the project, such as makhalla (local women's community), business women's association, teachers, khokiyamat and cross section of residents of Jasliq and Karakalpakiya to understand the local needs, priorities and demands and responses to the proposed project. In order to achieve the objectives of the study, a set of tools and techniques were used to elicit information from the various stakeholders.
123. A socio-economic sample survey was carried out to assess the socio-economic condition of the people of Jasliq and Karakalpakiya, the two settlement that are in the project area. The sampling methodology adopted was simple random sampling (srs) with proportional allocation. In all 324 sample households were surveyed, spread over the two settlements. The survey was carried out between 21 March 2019 and 29 March 2019.
124. The study revealed that 17 percent of the households are headed by women. The 19 to 45 age group than can involve itself actively in economic activity constitute 43 percent. The average size of a family is 4.37. Between men and women, the women's educational attainment is marginally higher than men from 5th standard and above. There are more unemployed women compared to men and in the not in workforce category, there is marginally more women than men.
125. Twenty nine percent of the members of the sample households surveyed are employed in public sector enterprises, followed by 2 percent who are private entrepreneurs, 1 percent are employed in private sector enterprises and unregistered entrepreneurs, non-agricultural labourers and those into farming together account for about 1 percent. Among the women 18 percent are employed in public sector (Gas compressor company and Railways), followed by 2 percent who are entrepreneurs, 1 percent comprising of those working in private sector and into farming and the rest are either unemployed (29%) or not in workforce.
126. Among those who are employed (451 out of 1417 persons), 3 percent are employed outside their place of living. With significant number of unemployed persons (19%) and educational attainment largely being up to secondary vocational education (59%), there is a need for focused interventions in skill development leading to employment.
127. The average monthly family income reported by the households was 2,187,947 som and the average monthly family expenditure reported by the households was 1,776,720 som. Twenty percent of the households reported of indebtedness and majority had borrowed from formal banking institutions. The cultivators mostly grow vegetables and fruits and the entire produce is consumed at home and produce is not sold. It was reported that majority of young girls are married after school graduation, and they become busy with household chores. The FGDs and data of makhalla statistic reveal that the young generation wish to continue their education. Most female graduates are involved in informal sector economic activities within

- the community. Some cook snacks and sell them in the train which halts for 20 minutes at the Jaslik station. The women consider this additional income significant to maintain the family.
128. In the consultations and FGDs held in Jaslik and Karakalpakstan, participants expressed the difficulty in accessing public transport and it was reported that the services were irregular and inadequate. This was reported as a cause for them being not able to go out of the settlement for studies and being contained within the settlements. The people were aware that secondary education is mandatory for all citizens of Uzbekistan and Republic of Karakalpakstan. Participants reported that there was no college in Jaslik settlement and young girls and boys had to travel either to Kungrad city or Karakalpakstan settlement. The choice of college mostly was said to depend on geographical location, locations where their relatives live. Young girls were mostly interested in medical and teaching profession.
129. Eighty five percent of the households reported that they travel out of their settlement either for going to hospital or market or work. Amongst those who reported of traveling outside their place of living, 76 percent reported of using public buses for commuting to hospital or market places or work, followed by 12 percent who engage a taxi, 9 percent reported of using cycle, 2 percent private owned cars and 1 percent private buses. Thirty eight percent of the respondents reported that the road condition was bad, followed by 31 percent who expressed the same view as the quality of the road being bad and together 69 percent response can be treated as who consider the road to be of poor quality. The other issues that were raised by the respondents include, shortage of public transport was reported by 15 percent of the respondents, lack of safety was reported by 7 percent of the respondents, insufficient number of traffic signs and lack of bus shelter was reported by 3 percent each, and the rest (3%) included traffic jams, inadequate number of gas stations, lack of toilet and lack of facility for women travelling with children.
130. Twenty six percent of the women wanted bus shelter with lighting, 23 percent wanted lighting at settlement junctions, 20 percent wanted increased frequency of public transport, 14 percent wanted provision of separate toilet for women, 11 percent wanted facility for mother and child at bus shelters and 6 percent wanted seats earmarked for women in public transport.
131. Shortage of public transport, lack of safety, insufficient number of traffic signs and lack of bus shelter, traffic jams, inadequate number of gas stations, lack of toilet and lack of facility for women travelling with children were indicated as issues in the present road. The proposed project includes overall 8 nos. of rest areas where the road user will be able make use of the toilets, space for women with children and shops that would sell food and other requirements of the road user.
132. Ninety nine percent of the respondents were aware of HIV-AIDS and were also aware how it spreads. However, estimates of UNAIDS for the year 2018 report an increase of 32 percent in new HIV infection since 2010 and hence, the project has proposed HIV awareness creation.
133. Ninety nine percent of the women have delivered in government hospital and the rest (1%) in private hospital. The response from the sample survey indicate that the two settlements viz. Jasliq and Karakalpakiya have achieved 100 percent institutional delivery. However, the region (Republic of Karakalpakstan) has higher infant, child and maternal mortality rate compared to the Republic of Uzbekistan and hence requires detailed assessment of the causes for high infant, child and maternal mortality rates in spite of having 100 percent institutional delivery.
134. Eighty eight percent of the respondent households reported that the women do not have title or license for the house and 12 percent reported that they have title or license for the house. Regarding mode of travel to market place, hospital, etc., 84 percent of the women reported of going by walk, followed by 13 percent who reported that they either walk or cycle, 2 percent reported of making use of the family car and 1 percent reported of using the car owned by self.
135. While the response to livelihood training was poor during the household survey, most of the women who participated in the FGDs (84 women from both Karakalpakstan and Jaslik) reported that they would be interested in livelihood training. The most preferred training amongst the women who were interested in undergoing training was sewing (37%) and followed by nursing (15%). Eleven percent were interested in pursuing higher education, 7 percent each in accounting and cooking and the rest were interested in other courses.

136. In Karakalpakstan, the head of mahalla committee and 17 women participated in the deliberations. The women expressed their desire to take up economic activity as most reported that they are unable to find any suitable employment. Stitching, baking and beautician are some of the opportunities that the women consider would have demand in their settlement. They requested for a training centre in Karakalpakstan, where they can get trained in connected skills, use the same premises for arranging coaching for students aspiring for higher education and avail specialised medical care. It was reported that they currently travel about 4 hours, one-way, to Kungrad for health care and coaching purpose. Lack of credit facility was reported as another factor affecting their plans for starting an enterprise.
137. In Jaslik, the head of mahalla committee and 16 women participated in the deliberations. The women expressed the need for a training centre, where they could be trained in livelihood skills. Preferred training included stitching, handicrafts, greenhouse farming and livestock rearing. They wanted a building where training could be imparted to them and also used for health and educational needs.
138. The women in Karakalpakstan, reported that availing of specialised health care is an issue in the settlement and that they have to travel to Kungrad to consult with gynecologist, dentist and other specialists. Prenatal care is said to be available only in Nukus. Further, the women reported that anemia among children is a problem and half the children in the settlement was reported to be anemic. The women wanted some recreational sports that would keep them healthy.
139. Most women in Jaslik are not involved in any income generating activity and some sell cooked food items by travelling in the train, that passes through their settlement. The absence of infrastructure has affected the efforts of the committee in organizing training programmes and health camps. The women reported that they require guidance in reproductive health care, pediatric care and dental care. Women reported of taking their children to Kungrad or Nukus for special coaching in select subjects required for qualifying for admission to higher education
140. The proportion of population living below the national poverty line⁶ in the Republic of Uzbekistan has reduced from 12.8 in the year 2015 to 11.4 in the year 2018. During the period between 2016 and 2018, the annual compounded growth rate of GDP was 5.2⁷ percent. Growth in GDP has direct bearing on the poverty levels and between 2016 and 2018, the GDP has been growing and correspondingly the proportion of poor has been falling.
141. There are 21.9 percent households who qualify under the low-income category in the project area and an assessment of the size of the household of low-income families reveal that larger the size of the family, higher the incidence of poverty. Educational attainment among low-income families is poor compared to the non-low-income families. Families with low income have fewer opportunities of being employed given the poor educational attainment. There are fewer women from low income families in public sector compared to the women from non-low-income families. There are no women from low income families in the private sector and interestingly there are more women from low income families as private entrepreneurs. The average monthly family income of the low-income family is UZS.1,111,957.7 compared to UZS.2,489,905 of the other non-low-income families

E.10 Road Safety and HIV/AIDS

142. The project can make use of the hotel at the border post at 240 km (existing 1204 km) for road safety awareness campaigns and creating awareness about HIV/AIDS. All trucks crossing the border, halt here and some stay overnight either making use of the accommodation provided at the hotel or in the truck itself. With large number of truck drivers making use of this facility, the project can explore the possibility of even installing a condom vending machine.

⁶ Source: *Economic Research and Regional Cooperation Department*, Asian Development Bank

⁷ Source: *Socio Economic Situation of the Republic of Uzbekistan*, The State Committee of the Republic of Uzbekistan on Statistics



Figure 3: Hotel on the RHS at 240 km
(existing chainage 1204 km)



Figure 4: Truckers taking a break

E.11 Socio-Economic and Resettlement Surveys and Analysis

143. The consultants carried out resettlement survey and sample baseline socio-economic survey for the preparation of Resettlement Plan and Poverty and Social Assessment Report. These activities, data analysis and the preparation of related reports were undertaken in the period from February to August 2019.

F. Road Development and Road Sustainability

F.1 Road Development

144. CAREC Corridor 2 connects the Caucasus and Mediterranean to East Asia. The route covers Azerbaijan, Kazakhstan, Turkmenistan, Uzbekistan, Tajikistan, the Kyrgyz Republic, and the People's Republic of China. It comprises 9,900 km of roads and 9,700 km of railways. Uzbekistan, being located in the central region of the said corridor, has the unique possibility to emerge as a center for trade and commerce. The benefits will be higher levels in the economic growth and better cooperation with neighboring countries as well as regional trade.
145. The in total 240 km long project is the last missing link in the CAREC Corridor 2 and will provide a trade access to the Caspian Sea. Most of the A380 road sections from Bukhara to km 964 have been reconstructed during the past years. In others construction works are ongoing or in the tender process. The condition of existing road pavement in the section from km 964 to km 1,204 on A380 is unsatisfactory. On major sections, there are continuous cracks, potholes, rutting, edge deterioration etc., forcing the drivers to reduce the travel speed. In some sections the existing pavement is completely deteriorated to a gravel road standard.
146. The road rehabilitation project includes the rehabilitation/upgrading of the project road to category II with two lanes and cement concrete pavement of the roadway. The application of a cement concrete pavement takes into account the availability of local materials, long expected useful life of the pavement and environmentally friendly characteristics of cement concrete.
147. The project road passes through the territory of the Kungrad region in the Republic of Karakalpakstan. Total population of the region is more than 1 million (1,066.8 thousand) and 550 000 people out of them is women. However, the section from km 964 to km 1,204 does not pass any noteworthy settlement. Its importance lies in the transit connectivity from Uzbekistan to the neighboring countries like Kazakhstan.
148. Nevertheless, the project road may contribute to the development of the two settlements located in some distance from A380 to the left by providing better access to the main road. A separate component for the development of the communities is included in the project. It proposes training of women, etc.
149. With the reconstruction of this road, there will be the possibility of bringing unemployed local people from the nearby settlements into employment. The travel time to the towns of Kungrad and Nukus can be reduced, using the modern road, herewith minimizing the travel cost as well.
150. The proposed investment program under ADB financing will rehabilitate 240 km of the road corridor on A380 from km 964 to km 1,204.
151. It is anticipated that construction works will be carried out in 6 lots. A separate PMU was formed as implementing agency under the Committee for Roads. Some of the PMU staff has been involved in previous projects under ADB financing and has respective experience in handling such. The TRTA includes the preparation of the tender documents based on the DD prepared by the RDI. The Procurement Assessment Report was prepared by the Consultant as well as the Construction Supervision ToR in coordination with the IA and ADB.

F.2 Road Sustainability

152. The outputs will be rehabilitation/upgrading of an international road section connecting Uzbekistan to Kazakhstan to 2 lanes with cement concrete pavement and improved road safety, providing a shorter high capacity link between the Kazakh border and the central/eastern parts of the country. Cement concrete pavement chosen for the 240 km on A380 requires less maintenance than asphalt cement concrete pavement and has a longer lifetime, thus ensuring a sustainable investment.
153. To ensure sustainability of the Uzbek road network, the CR and ADB agreed to include a component on traffic management and monitoring under the Karakalpakstan Road Project. The details of this component will be designed in consultation with the CR and comprises the

installation of an Intelligent Transport System (ITS) on a pilot section of Tashkent – Namangan road (A373).

154. To ensure axle load controls and thereby prevent pre-mature pavement failure, weigh-in-motion (WIM) systems will be installed at three locations, but outside the 240 km on A380. Two of the selected locations are on A373 road and the third is on M39 road. This will restrict vehicle overloading and preserve the life-span of pavement and contribute to pavement preservation. CR will update the regulations relating to axle load control.

G. Detailed Design and Cost of Karakalpakstan Road Project

G.1 Introduction

G.1.1 Description of the Project Road Section

156. The purpose of the project is to reduce vehicle operating costs and travel time mostly in the transit traffic by reconstructing the Kungrad to Daut-Ata section of A380 (km 964 to km 1,204). The project road has a length of 240 km and ends at the BCP with Kazakhstan, thereby contributing to the growth of transport and trade between the Republic of Uzbekistan and the neighboring countries. This road will be the last mile connectivity on the CAREC Corridor 2 and will provide a trade access to the Caspian Sea.
157. Start of the project road is at km 964 of A380 with design chainage km 0+000, at the end of the previous road section already contracted for rehabilitation. The project alignment follows the existing A380 road only in some sub-sections, namely from km 0 to approx. km 10, from km ca. 79 to km ca. 110 and from km ca. 219 to the end (km 240). In the other sub-sections, the design route mainly runs on an abandoned old gravel/earth road in various distance to the left of the existing A380. The DD was prepared in 40 km long sub-sections to expedite the design works and to consider the division of the 240 km road length into 6 lots, using a continuous design chainage throughout the full project road length.
158. The project alignment does not pass any noteworthy settlement. The closest buildings of the two settlements in the project section (Jasliq and Karakalpakiya) are about 1 km to the left of the design alignment. However, a few buildings adjacent to the police control point at km ca. 220 and the BCP at the end of the section are closer to the alignment, but outside the ROW. There is one tea house as per the topographic survey at km ca. 219+975, which seems to be located inside the ROW. A detail survey as part of the social due diligence will be undertaken and a LARP be prepared, if the building proves to be affected by the project.
159. No big structures like box culverts or bridges are located in the project road. At km ca. 1049+650 (design km 85+587.02) the road crosses a railway line, which is not secured by any technical equipment. Only beacons and the St Andrew's crosses inform drivers about the level crossing ahead. Some gas pipelines and electric power lines are located in the project area too. There is no existing bridge and only a handful existing drainage structures of different openings.
160. The transport of construction materials like bitumen, cement, aggregates, prefabricated concrete elements etc. is foreseen by the parallel running railway line. Railway stations are located in approx. 19 to 25 km interval along the railway line. The distance between the project alignment and the railway line varies between about 1.1 km and 8.5 km with an average distance of less than 2 km. From each nearest railway station construction materials will then be hauled by road to the project site.
161. The figure below gives an overview of the road section described above proposed for ADB financing.



Figure 5: Overview of Karakalpakstan Road Project

162. The project focuses on the reduction of travel time and VOC and the improvement of road safety by rehabilitation/reconstruction of a category II road with cement concrete pavement. The construction of new rest areas, installation of road furniture, signing and marking, street lighting at the BCP, reconstruction and construction of culverts are other main project features.
163. The existing A380 motor road was built starting in 2002 as a gravel road. Successively bituminous layers were added on top. It has 2 lanes at its whole length and corresponds to road category II according to ShNK 2.05.02-07. The pavement of the road is mainly asphalt, in most areas bituminous gravel, made by in-situ mixing on the road, which cannot be considered as asphalt concrete according to current specifications.
164. The condition of the existing road pavement is unsatisfactory. On major sections, there are continuous cracks, potholes, rutting, raveling, edge deterioration etc. In some sub-sections the road has deteriorated to a gravel road standard.
165. The road rehabilitation project includes the rehabilitation/reconstruction of the design road as a category II road and in general cement concrete pavement of the roadway. The application of a cement concrete pavement takes into account the availability of local materials, long expected useful life of the pavement and environmentally friendly characteristics of cement concrete as well as the shortage of bitumen in Uzbekistan.
166. The 240 km section on A380 passes through the territory of the Republic of Karakalpakstan. Total population of Karakalpakstan is more than 1.8 million (1,817.5 thousand). Although the project area is not close to the major cities, the rehabilitation of this road may bring the possibility for creating short-term jobs for people living in the vicinity of the project road and bring unemployed people into employment. The transport time of goods between the Republic of Uzbekistan and neighboring countries can be reduced, using the modern road, herewith minimizing VOC.
167. The proposed project will contribute to the effective, safe and sustainable road network and increase of traffic capacity in the Republic of Karakalpakstan with a design axle load of 13 ton. It will lead to enhanced regional trade on the CAREC Corridor 2 between Uzbekistan and Kazakhstan. The outcome will be improved travel time and efficiency on the reconstructed section of the A380 highway.

G.1.2 Documents made available

168. As agreed in the meeting at RDI on November 16, 2018, the DD drawings were scheduled to be submitted to SHELADIA in 40 km long sub-sections, beginning on November 16. Thus, the last sub-section was due on December 17. However, the actual submission slightly deviated from the schedule to both sides. The Consultant undertook an initial review of the submitted drawings for plausibility and consistency with the design guidelines in force in Uzbekistan. Initial comments to the DD drawings were shared with RDI subsequently in a timely manner to enable them addressing the comments as deemed reasonable.
169. For the 240 km project road sections, a set of updated DD drawings was received by the Consultant from RDI on December 28. This set of DD drawings was prepared in consideration of the initial comments by SHELADIA. The DD documentation was however not yet complete. Missing information comprised among others:
 - DD Design Report
 - EIA Report
 - Tables and maps of geotechnical investigations and laboratory test results
 - Topographical Report
 - Road inventory data
 - Utility relocation drawings
 - Technical equipment drawings at the railway level crossing, if required
 - Hydrological calculations
170. Early March the BoQ for all 6 lots and about one week later the cost estimates were submitted to the Consultant. They were reviewed and comments to them have been included in the design review report, which was submitted to ADB and PMU on March 30, 2019.
171. Technical Specifications were submitted to SHELADIA team and have been reviewed as well. Comments were shared with RDI on April 10, 2019.

172. An updated set of all available DD drawings was submitted on April 24, 2019, to the Consultant. It was noted, that many drawings are not fully or not translated into English. The designer shall include the translation before the drawings will be issued for tender.

G.1.3 Composition of the DD Documentation

173. To accelerate the preparation of the DD documentation for the Karakalpakstan Road Project, the 240 km section on A380 was divided into a number of 40 km long subsections. The DD drawings were received in the following sub-sections:

Subsection 1: km 0+000 to km 40+000

Subsection 2: km 40+000 to km 80+000

Subsection 3: km 80+000 to km 120+000

Subsection 4: km 120+000 to km 160+000

Subsection 5: km 160+000 to km 200+000

Subsection 6: km 200+000 to km 240+204.92

174. Each sub-section consists of a number of volumes. The volumes are further structured into books, if required. However, it shall be noted that the DD documentation has not yet been compiled for submission and the drawings the Consultant received in December 2018 are not in line with the structure as shown below:

- Volume I: Agreed Documents. Design Report.
- Volume II: Technical Part.
- Book 1. Technical solutions.
- Book 2. Cross sections. Part 1
- Book 3. Cross sections. Part 2
- Book 4. Cross sections. Part 3
- Book 5. Cross sections. Part 4
- Book 6. Short time car parking (rest areas).
- Volume III: Utilities.⁸
- Book 1. Communication lines.
- Book 2. Gas pipelines.
- Book 3. Power line.
- Book 4: Water pipelines.
- Volume IV: Bills of Quantities.
- Book 1. Road part.
- Book 3. Cost estimate.
- EIA.⁹

175. The division into subsections was made to expedite the preparation of the DD and because the civil works were proposed to be implemented in 6 lots of equal length. In comparison to the DD documentation for the Kashkadarya Regional Road Project in 2016, when six different sub-consultants prepared the documentation without clear guidelines from RDI, the drawings of the various sub-sections are consistent.

G.2 Traffic Studies and Forecast

176. The Average Annual Daily Traffic (AADT) on the project road as reported in the TDI project report is on average 2186 vehicles per day in 2018. The TDI traffic counts are based on counts by the road agency for 4 hours and expanded to AADT using standard conversion factors applicable to Uzbekistan¹⁰. The traffic is more or less uniform throughout the road section with the majority of the traffic recorded as through traffic going to the border. In number of vehicles, the majority of traffic is recorded as passenger cars, constituting about 62%, while goods vehicles constitute about 34% of the total traffic. The share of buses at 3.3% of the total is low. As part of due

⁸ The number and order of books of utility relocation drawings may vary depending on the actual need.

⁹ The EIA covers the whole length of the project road.

¹⁰ Standard factors are given in Appendices G and F of MKN 45-2007 "Instructions for traffic counts on motor roads"

diligence, the ADB TA team did undertake a 3-day traffic count and origin-destination survey on the project road. The traffic volume observed during the count which was during the lean winter period was 902. Considering both traffic estimates, an average of the TDI traffic figures and the winter count was adopted as the 2018 normal traffic on the project road and is given in table 4. Passenger vehicles dominate the traffic with a share of 68.4% followed by multi-axle vehicles (auto-trains) with a share of 23.9%. Hourly traffic data indicate a fairly equal share of traffic flow during day and night hours with hourly volume ranging from 2 to 6% of daily traffic.

Table 4: Base Year Traffic Volume along Project Road (2018)

Traffic Section	AADT (Motorized Vehicles)	Percent Share of AADT				
		Cars and Vans	Buses	Goods Vehicles	Two Wheelers	Agricultural Vehicles
A380 (Km 964-1204)	1546	65.6	2.8	28.9	0.8	1.9

AADT = Annual Average Daily Traffic.

Source: PPTA Consultant estimate.

177. The results of the origin-destination survey are given in table 5 which indicate that share of local traffic is low and over 90% of the traffic is generated by international trade and travel including transit traffic of 11% through Uzbekistan. Therefore, traffic forecasts for this road need to be developed on the basis of Uzbekistan's export prospects likely to use the project road and imports coming to Uzbekistan from west and northwest. Most of the passenger/car traffic is likely to be linked with Uzbeks working abroad, mainly in Russia. The demand for Uzbek exports and labour served by this road are likely to be dependent on the economic development and growth prospects of Russia and other countries to the north and west of Uzbekistan.

Table 5: Origin/Destination (O/D) Survey Results

Origin/Destination	Uzbekistan	Kazakhstan	Russia	Europe	Tajikistan	Turkmenistan	Total
Uzbekistan	6.2	18.5	18.5	9.9	0.0	0.0	53.1
Kazakhstan	14.8	0.0	0.0	0.0	0.0	0.0	14.8
Russia	12.3	0.0	0.0	0.0	4.9	1.2	18.5
Europe	8.6	0.0	0.0	0.0	3.7	1.2	13.6
Tajikistan	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Turkmenistan	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	42.0	18.5	18.5	9.9	8.6	2.5	100.0

Source: PPTA Consultant estimate

178. Uzbekistan economy grew rapidly by about 8.0% for ten years including 2015, but slowed down to 6.2% in 2016 and further to 4.5% in 2017. There was some acceleration of growth to 5.1% in 2018. The growth is expected to stay at a level of 5.5% in 2019-20 and is expected to grow at a faster rate in following years. As noted above, the traffic on Project Road A380 is mainly foreign trade and travel related. Traffic on this road is generated by foreign trade and is dominated by trade between Uzbekistan and Russia as well as Uzbek guest workers working in Russia. The biggest component of foreign trade with Russia using this road consist of horticultural products (fruits and vegetables). The production and trade of these are increasing more rapidly than the economy in average. As regards to the passenger car traffic, generated by the Uzbek guest workers, there is no indication that the demand for labour by the Russian infrastructure and building sector would be significantly lower in the near future.
179. The local agencies of the CR collect traffic data on main road network annually and past traffic data on project road sections available has been collected to analyse the historic growth trend of traffic. The analysis indicates a growth rate of 2.1% per annum on project road section between 2015 and 2018. This period also represents a slowdown in economy and therefore may have affected the growth rates. The data obtained from State Customs Committee on the number of vehicles crossed and the goods transported (combined export and import) at the border with Kazakhstan for the years 2014 to 2018 was analysed. The analysis indicate that car volume has

more than doubled and have grown at an average of 21.9% per annum during this period and volume of import and export in terms of weight grew at an annual rate of 4.8% during this period. The import and export for the country as a whole¹¹ indicate that imports grew at an annual rate of 6.4% and exports grew at an annual rate of 0.6% per annum in volume terms in the last 10 years.

180. The national statistics on transport movement of commodities (tons and ton-km) and passengers (persons and person-km) published by the Committee of Republic of Uzbekistan on Statistics on their website (www.stats.uz) was analyzed to understand the country level traffic. The analysis indicates that freight movement by road has increased from 638.6 million tons in 2005 to 1327.4 million tons in 2014 showing an annual growth rate of 8.5% and passenger movement by road has increased from 3796.4 million passengers in 2005 to 7244.4 million passengers in 2014 showing an annual growth rate of 7.4%.
181. An approach to assess traffic growth is to examine population and economic growth as well as the growth of traffic and to establish the 'transport demand elasticity' that can be used to estimate future traffic growths based on forecasts of economic growth. The Uzbekistan economy has grown at an average of 7.4% and per capita income grew at an average of 5.6% during the period between 2012 and 2017. The analysis of economic growth and passenger and commodity movement growth over a 10-year period (2005-2014) indicate an elasticity of 1.0 for freight traffic (tons) with respect to GDP growth and 1.15 for passenger trips with respect to per capita income growth. The economic forecast for 2019 and 2020 by the ADB for Uzbekistan is 5.1 and 5.5%.¹² The International Monetary Fund (IMF) projections indicate a growth rate of 5% to 6% between 2018 and 2024¹³.
182. The traffic growth along the project road section is expected to be in line with import and export growth and the past trend observed at the border traffic as well as overall economic growth in Uzbekistan and growth prospect of Karalpakstan Republic. Based on these considerations, the traffic growth rates for projections have been assumed as given in table 6.

Table 6: Suggested Growth Rates (%) for Traffic Projection

Period	Traffic growth rate (%)		
	Car	Bus	Goods Vehicles
2018-2023	6.0	4.0	4.0
2023-2028	5.0	3.0	3.0
Beyond 2028	4.0	2.0	3.0

Source: PPTA Consultant estimate

G.3 Topographical Survey

183. The corridor of topographical survey works was determined based on small-scale maps and pre-identified alignment options, of which the most likely options were selected. Surveying and desktop processing of field works were carried out in 2016 for the entire length of the route from km 964 to km 1,204. The works were carried out using modern work methods and instruments.
184. Initially 90 points were fixed in the field with GPS receivers type Leica GS-10. The distance between these points and points measured on the alignment was recorded with a ProMark 3 Magellan device in GOTO mode. The results of the primary measurement works were processed by the program "LEICA Geo Office Combined" and transferred to the format "RINEX". The final linking of the points was done by the Trimble Total Control program. Following the coordinates have been converted from the WGS-84 coordinate system with the Photomod GeoCalculator program to SK-42 coordinate system.
185. Topographical survey works on the A-380 road in the section from km 964 to km 1204 were conducted in a corridor of 50 m to each side of the proposed centerline with a Leica

¹¹ World Development Indicators, World Bank Database

¹² ADB. 2018. *Asian Development Outlook Update 2018*. Manila

¹³ https://www.imf.org/external/datamapper/NGDP_RPCH@WEO/UZB

TS02.TSRA1101 total station, the marks were taken every 25 m in transverse profiles. The desktop works were carried out by the CREDO DAT program.

186. During the field works all relevant topographical details as existing roads, accesses, artificial structures, underground and overhead communications, buildings, intersections, built-up areas, etc. were surveyed. A geodetic network was established in local coordinate systems. New benchmarks are set at a distance of about 1.0 km from each other along the project route. Due to the distance of the benchmarks from the project alignment, they are not displayed in the plan drawings.

G.3.1 Benchmarks

187. A table of benchmarks is displayed in the DD plan drawings. In total 241 benchmarks in form of a 1m long reinforcement bar in a concrete foundation were established in the course of the topographical field works. The information provided contains the benchmark number, the chainage and distance from the center line and the level. Easting and northing are not provided. However, the data submitted by RDI includes tables of centerline coordinates in 25 m interval, which are sufficient to set out the alignment.

G.3.2 Conclusion

188. The equipment and software used to carry out the topographical survey and data processing are modern. The data recorded during the topographical survey works shown on the plan drawings and in excel tables is assessed to be fit for procuring the civil works.

G.4 Geotechnical Investigations

G.4.1 Geological Overview

189. The investigated road section from km 964 to km 1,204 on A380 is located in the northwestern promontory part in the Kungrad region of the Republic of Karakalpakstan on the Ustyurt Plateau. The geological formation of the project area is characterized by sediments of the quaternary period of the Cenozoic era. Alluvial and deluvial deposits of low thicknesses represent the quaternary period. They are underlain by genuine rock of lime and marl. Prevailing soil types are loam and silt. Interlayers and lenses of sand and cobble often exist in the upper soil layers. At certain spots the genuine rock can be found at the surface.
190. From lithologic side the project road section consists of grounds of fine sand and silt with inclusions of gravel and gypsum. Forest type clayey loam can often be found. Soils in the investigated areas are slight to medium saline. The amount of dissolved solids is varying from 366 to 2315 mg/kg. The content of chloride ions varies from 64 to 177 mg/kg, sulphate ions vary from 178 to 1344 mg/kg. Grounds are medium aggressive to Portland cement concretes as per GOST 10178-85.
191. Ground water at the whole road length was not determined down to 3 m below existing ground. It is mainly fed by infiltration of atmospheric precipitation.

G.4.2 Natural Conditions in the Region of Construction Works

192. According to SHNK 2.05.02-07 "Highways", the planned road section refers to road climatic zone I. The climate of the project area is extremely continental. Average temperatures are as follows: in July + 27.0 ° C, in January - 8.2 ° C, annual + 9.1 ° C. The absolute minimum temperature was recorded with - 45 ° C, the absolute maximum temperature was + 45.5 ° C.
193. Precipitation is mainly due to rain. The annual rainfall was determined with 145.8 mm. The maximum daily rainfall is 51.0 mm, the number of precipitation days per year - 108 days. Average 63 days per year a snow cover exists, the number of hours of thunderstorms during the year is 18.6 hours.

194. In winter, winds from east and southeast prevail, while in summer winds between east and west by north are dominant. The average snow cover is in the range of 4 to 8 cm with a maximum of 30 cm.

G.4.3 Field Works

195. The geotechnical report elaborated during the preparation of the FS documentation for the 240 km road section on A380 was made available to SHELADIA team. Geotechnical Investigations were carried out in July and August 2016 by specialists of RDI and sub-consulting companies. Their objective was to:

- identify the lithology of the road corridor
- determine the physical, mechanical and chemical properties of the subsoil
- investigate the existence of ground water, determine its chemical properties and the possible impact on the design and construction works

196. Also, in the period from July to August 2016 engineering-geotechnical investigations were carried out to determine suitable quarries for road construction materials. Initially 27 nos. of soil borrow pits were investigated. The volume of suitable embankment fill material was determined as 1.779 million m³. Since the volume of fill material for the 240 km length of the project road is much higher, additional 50 nos. of borrow pits were determined. To identify the quantity of available materials measurements were carried out and samples were taken to determine the mechanical properties of the available materials. Laboratory tests verified if the materials are suitable for road construction purposes. The location of each quarry was recorded to assess the hauling distance of the construction material. Sources for road construction materials were investigated and have been identified for the use during the construction works.

197. Works undertaken within the project road corridor are shown in the following table.

Table 7: Investigations along the project corridor

No.	Type of investigation	Unit	Quantity
1	2	3	4
Field works			
1	Trial pits up to 3.0 m depth in soil of category II and taking of soil samples	m	1,200
2	Taking of disturbed soil samples	No.	240

198. For the works undertaken related to the identification of construction material sources (borrow pits), a separate report was prepared. The following table presents the works carried out.

Table 8: Borrow pit investigations

No.	Type of investigation	Unit	Quantity
1	2	3	4
Field works			
1	Trial pits up to 3.0 m depth in soil of category II and taking of soil samples	m	324
2	Trial pits up to 3.0 m depth in soil of category IV and taking of soil samples	m	135
3	Taking of disturbed soil samples	No.	67

199. In none of the trial pits down to 3 m beneath the existing terrain ground water was encountered. Layers of encountered materials beneath the existing road pavement respectively the top layer of the abandoned earthen road were recorded and in general can be described as:

- Fill material type a (heavy loess and silt of stiff and semi-stiff consistency, partially with admixtures of gravel and pebble)

- Fill material type b (crushed rock material of lime stone and marl). This material would require blasting to be loosened. However, the vertical alignment of the project road does not require cuts except for side ditches at some spots.
 - Sub grade of loess loam with layers of sandy silt, stiff to light plastic consistency. Prevalent in the lower layers of trial pits.
 - Sub grade of marl, shell lime and weathered lime stone with rock boulders. At the whole length of the project alignment in 1.2 to 2.2 m depth.
200. No further field tests like for example load bearing plate or DCP testing were carried out in the field. The field team took samples of the soil as shown in the tables above and brought them to a laboratory for further testing.

G.4.4 Laboratory Testing

201. Soil samples taken from the field were tested at the laboratory to determine the mechanical properties. Water was extracted from a number of soil samples and was tested for chemical properties. The number of tests is evident in the tables below:

Table 9: Laboratory testing along the project corridor

No.	Type of investigation	Unit	Quantity
1	Determination of mechanical properties of soil	No.	67
2	Water extract from soil	No.	35

Table 10: Borrow pit laboratory testing

No.	Type of investigation	Unit	Quantity
1	Determination of mechanical properties of soil	No.	67
2	Soil compression test	No.	12
3	Water extract from soil	No.	53

202. Synoptically, the results of the testing program can be summarized as follow:
- The density of the fill material type a is 1.69 t/m³
 - The density of the fill material type b is in the range of 1.95 to 2.2 t/m³
 - The natural density of the sub-grade material varies from 1.69 to 2.3 t/m³
 - The elasticity modulus of the fill material type a according to MKN 46-2008 is 62 MPa. The inner friction angle is 18° and cohesion accounts for 0.019 MPa
 - The elasticity modulus of the sub-grade according to MKN 46-2008 is also 62 MPa. The inner friction angle is 22° and cohesion accounts for 0.019 MPa. These values shall be considered in the pavement structure calculations
 - Existing soils are little or medium saline, and are medium aggressive to steel, and concrete.
 - Sulfate-resistant cement and corrosion protection for steel products, e.g. anchors, to be applied
203. The design considered the recommendations above. Results of the laboratory testing of soil samples from trial pits along the road and from borrow pits are presented in the following tables.

Table 11: Laboratory test results of soil samples from trial pits along the project road

S No	Sample location	Pit number	Pit depth, m	Natural density g/cm ³	Natural moisture content %	Particle density g/cm ³	Porosity coeff.	Dry density g/cm ³	Moisture level	Moisture content at liquid limit	Moisture content at plastic limit	Plasticity number	Consistency	Type of soil	Swelling %
1	Road	P-1	1-1,5		4.40	2.70								Gypsum loam	
2	Road	P-3	0,5-1,3	1.48	2.50	2.68	0.86	1.44	0.08	19.93	13.32	6.61	-1.64	Stiff sandy loam	50
3	Road	P-10	1.0	1.48	4.54	2.68	0.89	1.42	0.14	17.09	11.95	5.14	-1.44	Stiff sandy loam	
4	Road	P-13	1.0	1.48	2.43	2.68	0.85	1.44	0.08	14.42	10.38	4.04	-1.97	Stiff sandy loam	
5	Road	P-18	1.3	1.65	6.46	2.70	0.74	1.55	0.24	15.34	13.62	1.72	-4.16	Stiff silt	20
6	Road	P-22	0.9	1.48	4.14	2.68	0.89	1.42	0.13	17.11	11.98	5.13	-1.53	Stiff sandy loam	
7	Road	P-30	0.4	1.48	1.38	2.68	0.84	1.46	0.04	14.95	12.95	2.00	-5.79	Stiff sandy loam	
8	Road	P-39	0.6	1.48	2.89	2.68	0.86	1.44	0.09	14.80	11.47	3.33	-2.58	Stiff sandy loam	20
9	Road	P-42	0.9	1.65	3.28	2.70	0.69	1.60	0.13	18.85	11.83	7.02	-1.22	Stiff silt	
10	Road	P-51	1.1	1.65	2.48	2.70	0.68	1.61	0.10	18.57	11.04	7.53	-1.14	Stiff silt	50
11	Road	P-55	1.2	1.48	2.89	2.68	0.86	1.44	0.09	18.23	11.65	6.58	-1.33	Stiff sandy loam	
12	Road	P-59	1.2	1.65	6.06	2.70	0.74	1.56	0.22	18.58	12.04	6.54	-0.91	Stiff silt	
13	Road	P-60	1.0	1.65	6.93	2.70	0.75	1.54	0.25	19.13	12.09	7.04	-0.73	Stiff silt	14
14	Road	P-62a	0.6	1.65	3.89	2.70	0.70	1.59	0.15	21.85	12.23	9.62	-0.87	Stiff silt	
15	Road	P-64a	0.7	1.65	12.58	2.70	0.84	1.47	0.40	26.56	16.26	10.30	-0.36	Stiff silt	58
16	Road	P-73	1	1.65	5.53	2.70	0.73	1.56	0.21	19.55	12.30	7.25	-0.93	Stiff silt	
17	Road	P-78a	1.3	1.65	3.09	2.70	0.69	1.60	0.12	19.2	9.87	9.36	-0.72	Stiff silt	
18	Road	P-80	0.8	1.65	2.94	2.70	0.68	1.60	0.12	20.87	10.87	10.00	-0.79	Stiff silt	
19	Road	P-87	1.1	1.48	3.56	2.68	0.88	1.43	0.11	19.24	13.4	5.83	-1.69	Stiff sandy loam	
20	Road	P-89	1.2	1.48	8.27	2.68	0.96	1.37	0.23	15.73	12.3	3.39	-1.20	Stiff sandy loam	21
21	Road	P-90a	0.7		4.01									Gypsum silt	
22	Road	P-96a	1.2		3.87									Gypsum	
23	Road	P-100a	1.3		3.18									Gypsum	
24	Road	P-105a	1.2	1.65	4.78	2.70	0.71	1.57	0.18	18.48	9.40	9.08	-0.51	Stiff silt	18
25	Road	P-127a	1.1		1.77									Gypsum	
26	Road	P-133a	0.8	1.65	3.64									Gypsum silt	
27	Road	P-140a	1.3	1.65	4.39									Gypsum silt	
28	Road	P-144	0.5	1.65	4.60	2.70	0.71	1.58	0.17	22.60	12.92	9.68	-0.86	Stiff silt	20
29	Road	P-153	1.5	1.65	4.87	2.70	0.72	1.57	0.18	26.78	11.55	15.23	-0.44	Stiff silt	
30	Road	P-160	1.0	1.48	3.12	2.68	0.87	1.44	0.10	20.91	14.51	6.40	-1.78	Stiff sandy loam	42
31	Road	P-170	0.8		4.88									Gypsum	
32	Road	P-180	0.8	1.65	1.94	2.70	0.67	1.62	0.08	21.78	13.05	8.73	-1.27	Stiff silt	30
33	Road	P-196	1.3		2.68			0.00				0.00		Gypsum	
34	Road	P-210	1.0	1.48	1.40	2.68	0.84	1.46	0.04	20.14	13.87	6.27	-1.99	Stiff sandy loam	16
35	Road	P-213	1	1.48	1.97	2.68	0.85	1.45	0.06	16.79	12.82	3.97	-2.73	Stiff sandy loam	

S No	Sample location	Pit number	Pit depth, m	Natural density g/cm ³	Natural moisture content %	Particle density g/cm ³	Porosity coeff.	Dry density g/cm ³	Moisture level	Moisture content at liquid limit	Moisture content at plastic limit	Plasticity number	Consistency	Type of soil	Swelling %
36	Road	P-218	1.0	1.65	2.68	2.70	0.68	1.61	0.11	25.16	14.31	10.85	-1.07	Silt	37
37	Road	P-224	0.7	1.65	1.92	2.70	0.67	1.62	0.08	23.05	14.02	9.03	-1.34	Silt	
38	Road	P-231	0.6	1.48	1.76	2.68	0.84	1.45	0.06	20.23	14.87	5.36	-2.45	Stiff sandy loam	20
39	Road	P-233	1.2	1.48	3.01	2.68	0.87	1.44	0.09	17.39	13.98	3.41	-3.22	Stiff sandy loam	
40	Road	P-241	0.7	1.48	2.45	2.68	0.86	1.44	0.08	18.20	14.03	4.17	-2.78	Stiff sandy loam	2

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Table 12: Laboratory test results of soil samples from borrow pits along the project road

S No	Sample location	Pit number	Pit depth, m	Natural density g/cm ³	Natural moisture content %	Particle density g/cm ³	Porosity coeff.	Dry density g/cm ³	Moisture level	Moisture content at liquid limit	Moisture content at plastic limit	Plasticity number	Consistency	Type of soil	Swelling %
1	Borrow pit	P-12	1.3		11.92							-	-	Gypsum	
2	Borrow pit	P-16	1.3		2.14									Gypsum	
3	Borrow pit	P-25	1		2.23									Gypsum	
4	Borrow pit	P-28	0.8		1.46									Gypsum	
5	Borrow pit	P-35	1		2.86									Gypsum	
6	Borrow pit	P-37	1.1		2.55									Gypsum	
7	Borrow pit	P-39	1.3		2.15									Gypsum	
8	Borrow pit	P-41	0.7	1.65	2.49	2.70	0.68	1.61	0.10	21.97	12.6	9.33	-1.09	Silt	31
9	Borrow pit	P-45	0.9	1.65	2.86	2.70	0.68	1.60	0.11	27.10	13.00	14.10	-0.72	Silt	
10	Borrow pit	P-46	1.2		3.24							0.00		Gypsum	
11	Borrow pit	P-50	0.7	1.65	3.62	2.70	0.70	1.59	0.14	19.57	12.28	7.29	-1.19	Silt	20
12	Borrow pit	P-54	1.1		2.55							0.00		Gypsum	
13	Borrow pit	P-58	0.7	1.65	2.72	2.70	0.68	1.61	0.11	20.96	13.48	7.48	-1.44	Silt	4
14	Borrow pit	P-64	0.9	1.65	3.76	2.70	0.70	1.59	0.15	27.39	17.73	9.66	-1.45	Silt	18
15	Borrow pit	P-71	1		2.85							0.00		Gypsum	
16	Borrow pit	P-76	0.7	1.65	3.57	2.7	0.69	1.59	0.14	27.39	13.49	13.90	-0.71	Silt	40
17	Borrow pit	P-83	1.2		1.78							0.00		Gypsum	
18	Borrow pit	P-85	0.8		2.87							0.00		Gypsum	
19	Borrow pit	P-96	0.6		2.01							0.00		Gypsum	
20	Borrow pit	P-15	0.8		2.87							0.00		Gypsum	
21	Borrow pit	P-53	0.9	1.48	3.40	2.68	0.87	1.43	0.10	18.84	13.10	5.74	-1.69	Sandy loam	40
22	Borrow pit	P-12	0.5	1.65	2.02	2.70	0.67	1.62	0.08	19.86	12.05	7.81	-1.28	Silt	
23	Borrow pit	P-16	0.6	1.48	9.66	2.68	0.99	1.35	0.26	18.67	13.97	4.70	-0.92	Sandy loam	
24	Borrow pit	P-35	0.4	1.65	6.41	2.70	0.74	1.55	0.23	22.83	12.27	10.56	-0.55	Silt	
25	Borrow pit	P-39	0.5	1.48	2.07	2.68	0.85	1.45	0.07	19.10	13.10	6.00	-1.84	Sandy loam	
26	Borrow pit	P-46	0.6	1.48	3.00	2.68	0.87	1.44	0.09	18.98	12.34	6.64	-1.41	Sandy loam	
27	Borrow pit	P-83	0.40	1.48	5.82	2.68	0.92	1.40	0.17	19.25	13.01	6.24	-1.15	Sandy loam	

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G.4.5 Earthworks

204. Where earthworks are required, these shall be designed with full attention to the nature of the available materials and their strength and engineering properties. Where the existing profile is altered or the road widened, care has to be taken to adequately choose and place the material according requirements and that new fill is properly bonded to the existing work and that new fill material is suitable for use in the specific circumstances in which it is to be placed.
205. As far as practical the material resulting from cuts or other excavations in the road reserve shall be utilized for construction of earthworks if suitable. Material which will not be used in earthworks due to quality or other reasons may be stockpiled for future use as topsoil or side fill.

G.4.5.1 Embankment Construction

206. In general, the rehabilitation and reconstruction of the 240 km long section of A380 of the Karakalpakstan Road Project will require the construction of new embankments as per design of RDI. In general, the new profile is raised 1.0 to 1.50 m against the existing road/embankment fill of the abandoned earth road. At some short sections, i.e. at the railway level crossing, the police control point and the approach to the border control point, the new profile is closer to the existing road level.
207. Due to the raised new profile, existing embankments are mostly to be widened. Also, for additional turning lanes at junctions, the police control point and at the approaches to the border control point widening of the existing cross section is required. Where widening of the existing embankment is designed, it is essential to avoid different settlements of the new road on top of the existing embankment and the new embankment, which may result from the different stiffness and degrees of compaction of the existing and new fill. For widening of the existing embankment, benching is an essential requirement for technically sound widening works, if the height of the new embankment is more than 3 m and the existing embankment slope ratio is steeper than 1:3 (V:H). Since the existing embankment fill of A 380 and the abandoned road is in general not higher than 1.0 m, it is assessed that benching is not required.

G.4.5.2 Construction of Cut Sections

208. At the whole length of the project road no cuts are foreseen. Only at the few spots where the design road level could not be substantially raised above the existing road, e.g. at the railway level crossing, a side ditch will be required. Adequate drainage in these short sections will be provided by the side drains.

G.4.6 Construction Material Sources

G.4.6.1 Quarries for Aggregates

209. There is no quarry for the supply of aggregates to be used in the pavement layers of the project road in close vicinity. Thus, such materials are foreseen to be brought from the Karatau quarry, located in the Amudarya district of Karakalpakstan. The quarry has a total reserve of more than 3 billion m³, meeting the requirements of GOST with a yearly production capacity of 2 million m³. Materials shall be transported by rail to the nearest railway station of each lot and be hauled from there by trucks.

G.4.6.2 Soil Borrow Pits

210. During the construction phase, the main material used will be soil for the new embankment fill. The geotechnical investigations included the determination of possible sources in the vicinity of the project road. A total number of 77 borrow areas was selected and the amount of available suitable materials assessed as 6.78 million m³. The first rough assessment of the volume required for embankment fill by SHELADIA team resulted in about 7.79 million m³. Therefore, the

volume available in the identified quarries is not sufficient. However, the geotechnical report indicates that in case of shortage of fill the area of the borrow pits may be extended.

211. The overview of the initially investigated 27 nos. of soil borrow pits located along the project road is given in the table below.

Table 13: Soil borrow pits

№	Soil lithological description	Pit № 1 (0,5 km) from 964 km right side				Pit № 2 (300 m) from 971 km right side			
		p-1	p-2	p-3	p-4	p-1	p-2	p-3	p-4
1	Top soil p.9 «b» ShNK-4.02.01-04	0,0-0,3	0,0-0,3	0,0-0,3	0,0-0,3	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2
2	Loam light loess-like, slightly plastic without impurities P. 35 «a»ShNK 4.02.01-01	0,3-1,1	0,3-1,1	0,3-1,1	0,3-1,1	0,2-0,6	0,2-0,6	0,2-0,6	0,2-0,6
3	Sandy loam								
4	Gypseous sand								
5	Weak marl limestone of medium strength p. 16 «b» ShNK 4.02.01-04.	1,1-2,3	1,1-2,3	1,1-2,3	1,1-2,3	0,6-1,6	0,6-1,6	0,6-1,6	0,6-1,6
6	Gypsum b. 7 ShNK 4.02.01-04	2,3-2,6	2,3-2,6	2,3-2,6	2,3-2,6	1,6-2,0	1,6-2,0	1,6-2,0	1,6-2,0
7	Marl of low strength p. 24 «b» ShNK 4.02.01-04.	2,6-2,8	2,6-2,8	2,6-2,8	2,6-2,8	2,0-2,2	2,0-2,2	2,0-2,2	2,0-2,2
	Pit depth. m	2,8	2,8	2,8	2,8	2,2	2,2	2,2	2,2
	Groundwater level	-	-	-	-	-	-	-	-

№	Soil lithological description	Pit № 3 (300 m) from 995 km right side				Pit № 4 (200 m) from 1001,5 km right side			
		p-1	p-2	p-3	p-4	p-1	p-2	p-3	p-4
1	Top soil p.9 «b» ShNK-4.02.01-04	0,0 -0,2	0,0 -0,2	0,0 -0,2	0,0 -0,2	0,0-0,3	0,0-0,3	0,0-0,3	0,0-0,3
2	Loam light loess-like, slightly plastic without impurities P. 35 «a»ShNK 4.02.01-01	0,2-0,9	0,2-0,9	0,2-0,9	0,2-0,9				
3	Sandy loam					0,3-1,0	0,3-1,0	0,3-1,0	0,3-1,0
4	Gypseous sand								
5	Weak marl limestone of medium strength p. 16 «b» ShNK 4.02.01-04.	0,9-1,2	0,9-1,2	0,9-1,2	0,9-1,2	1,0-1,5	1,0-1,5	1,0-1,5	1,0-1,5
6	Gypsum b. 7 ShNK 4.02.01-04	1,2-1,7	1,2-1,7	1,2-1,7	1,2-1,7	1,5-1,9	1,5-1,9	1,5-1,9	1,5-1,9
7	Marl of low strength p. 24 «b» ShNK 4.02.01-04.	1,7-2,0	1,7-2,0	1,7-2,0	1,7-2,0	1,9-2,2	1,9-2,2	1,9-2,2	1,9-2,2
	Pit depth. m	2,0	2,0	2,0	2,0	2,2	2,2	2,2	2,2
	Groundwater level	-	-	-	-	-	-	-	-

№	Soil lithological description	Pit № 5 (50 m) from 1003,6 km right side				Pit № 6 (100 m) from 1008 km right side			
		p-1	p-2	p-3	p-4	p-1	p-2	p-3	p-4
1	Top soil p.9 «b» ShNK-4.02.01-04	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2
2	Loam light loess-like, slightly plastic without impurities P. 35 «a»ShNK 4.02.01-01					0,2-1,2	0,2-1,2	0,2-1,2	0,2-1,2
3	Sandy loam								
4	Gypseous sand								
5	Weak marl limestone of medium strength p. 16 «b» ShNK 4.02.01-04.								
6	Gypsum b. 7 ShNK 4.02.01-04					1,2-1,6	1,2-1,6	1,2-1,6	1,2-1,6
7	Marl of low strength p. 24 «b» ShNK 4.02.01-04.	0,2-1,5	0,2-1,5	0,2-1,5	0,2-1,5	1,6-2,0	1,6-2,0	1,6-2,0	1,6-2,0
	Pit depth. m	1,5	1,5	1,5	1,5	2,0	2,0	2,0	2,0
	Groundwater level	-	-	-	-	-	-	-	-

№	Soil lithological description	Pit № 7 (100 m) from 1015,3 km right side				Pit № 8 (100 m) from 1017,8 km right side			
		p-1	p-2	p-3	p-4	p-1	p-2	p-3	p-4
1	Top soil p.9 «b» ShNK-4.02.01-04	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2
2	Loam light loess-like, slightly plastic without impurities P. 35 «a»ShNK 4.02.01-01	0,2-0,6	0,2-0,6	0,2-0,6	0,2-0,6	0,2-0,7	0,2-0,7	0,2-0,7	0,2-0,7
3	Sandy loam	0,6-0,8	0,6-0,8	0,6-0,8	0,6-0,8				
4	Gypseous sand					0,7-1,0	0,7-1,0	0,7-1,0	0,7-1,0
5	Weak marl limestone of medium strength p. 16 «b» ShNK 4.02.01-04.					1,0-1,3	1,0-1,3	1,0-1,3	1,0-1,3
6	Gypsum b. 7 ShNK 4.02.01-04	0,8-1,2	0,8-1,2	0,8-1,2	0,8-1,2	1,3-1,6	1,3-1,6	1,3-1,6	1,3-1,6
7	Marl of low strength p. 24 «b» ShNK 4.02.01-04.	1,2-1,8	1,2-1,8	1,2-1,8	1,2-1,8	1,6-2,0	1,6-2,0	1,6-2,0	1,6-2,0
	Pit depth. m	1,8	1,8	1,8	1,8	2,0	2,0	2,0	2,0
	Groundwater level	-	-	-	-	-	-	-	-

№	Soil lithological description	Pit № 9 (100 m) from 1019,8 km right side				Pit № 10 (100 m) from 1025 km right side			
		p-1	p-2	p-3	p-4	p-1	p-2	p-3	p-4
1	Top soil p.9 «b» ShNK-4.02.01-04	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2
2	Loam light loess-like, slightly plastic without impurities P. 35 «a» ShNK 4.02.01-01					0,2-0,7	0,2-0,7	0,2-0,7	0,2-0,7
3	Sandy loam								
4	Gypseous sand								
5	Weak marl limestone of medium strength p. 16 «b» ShNK 4.02.01-04.	0,4-1,6	0,4-1,6	0,4-1,6	0,4-1,6	1,2-2,0	1,2-2,0	1,2-2,0	1,2-2,0
6	Gypsum b. 7 ShNK 4.02.01-04					0,7-1,2	0,7-1,2	0,7-1,2	0,7-1,2
7	Marl of low strength p. 24 «b» ShNK 4.02.01-04.	0,2-0,4	0,2-0,4	0,2-0,4	0,2-0,4				
	Pit depth. m	1,6	1,6	1,6	1,6	2,0	2,0	2,0	2,0
	Groundwater level	-	-	-	-	-	-	-	-

№	Soil lithological description	Pit № 11 (50 m) from 1033,4 km right side				Pit № 12 (50 m) from 1039,6 km right side			
		p-1	p-2	p-3	p-4	p-1	p-2	p-3	p-4
1	Top soil p.9 «b» ShNK-4.02.01-04	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2
2	Loam light loess-like, slightly plastic without impurities P. 35 «a» ShNK 4.02.01-01					0,2-0,8	0,2-0,8	0,2-0,8	0,2-0,8
3	Sandy loam					0,8-1,3	0,8-1,3	0,8-1,3	0,8-1,3
4	Gypseous sand	0,2-0,6	0,2-0,6	0,2-0,6	0,2-0,6				
5	Weak marl limestone of medium strength p. 16 «b» ShNK 4.02.01-04.	0,6-1,8	0,6-1,8	0,6-1,8	0,6-1,8	1,3-2,0	1,3-2,0	1,3-2,0	1,3-2,0
6	Gypsum b. 7 ShNK 4.02.01-04								
7	Marl of low strength p. 24 «b» ShNK 4.02.01-04.								
	Pit depth. m	1,8	1,8	1,8	1,8	2,0	2,0	2,0	2,0
	Groundwater level	-	-	-	-	-	-	-	-

№	Soil lithological description	Pit № 13 (50 m) from 1044 km right side				Pit № 14 (200 m) from 1058,2 km right side			
		p-1	p-2	p-3	p-4	p-1	p-2	p-3	p-4
1	Top soil p.9 «b» ShNK-4.02.01-04	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2
2	Loam light loess-like, slightly plastic without impurities P. 35 «a» ShNK 4.02.01-01	0,2-1,0	0,2-1,0	0,2-1,0	0,2-1,0	0,2-0,8	0,2-0,8	0,2-0,8	0,2-0,8
3	Sandy loam								
4	Gypseous sand	1,0-1,4	1,0-1,4	1,0-1,4	1,0-1,4	0,8-1,3	0,8-1,3	0,8-1,3	0,8-1,3
5	Weak marl limestone of medium strength p. 16 «b» ShNK 4.02.01-04.	1,4-2,5	1,4-2,5	1,4-2,5	1,4-2,5	1,3-1,6	1,3-1,6	1,3-1,6	1,3-1,6
6	Gypsum b. 7 ShNK 4.02.01-04					1,6-2,0	1,6-2,0	1,6-2,0	1,6-2,0
7	Marl of low strength p. 24 «b» ShNK 4.02.01-04.					2,0-2,2	2,0-2,2	2,0-2,2	2,0-2,2
	Pit depth. m	2,5	2,5	2,5	2,5	2,2	2,2	2,2	2,2
	Groundwater level	-	-	-	-	-	-	-	-

№	Soil lithological description	Pit № 15 (300 m) from 1068 km right side				Pit № 16 (200 m) from 1077 km left side			
		p-1	p-2	p-3	p-4	p-1	p-2	p-3	p-4
1	Top soil p.9 «b» ShNK-4.02.01-04	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2
2	Loam light loess-like, slightly plastic without impurities P. 35 «a» ShNK 4.02.01-01	0,2-0,7	0,2-0,7	0,2-0,7	0,2-0,7	0,2-0,6	0,2-0,6	0,2-0,6	0,2-0,6
3	Sandy loam								
4	Gypseous sand	0,7-1,4	0,7-1,4	0,7-1,4	0,7-1,4				
5	Weak marl limestone of medium strength p. 16 «b» ShNK 4.02.01-04.	1,4-2,2	1,4-2,2	1,4-2,2	1,4-2,2	0,6-1,6	0,6-1,6	0,6-1,6	0,6-1,6
6	Gypsum b. 7 ShNK 4.02.01-04					1,6-2,4	1,6-2,4	1,6-2,4	1,6-2,4
7	Marl of low strength p. 24 «b» ShNK 4.02.01-04.					2,4-2,6	2,4-2,6	2,4-2,6	2,4-2,6
	Pit depth. m	2,2	2,2	2,2	2,2	2,6	2,6	2,6	2,6
	Groundwater level	-	-	-	-	-	-	-	-

№	Soil lithological description	Pit № 17 (100 m) from 1099 km right side				Pit № 18 (100 m) from 1107 km right side			
		p-1	p-2	p-3	p-4	p-1	p-2	p-3	p-4
1	Top soil p.9 «b» ShNK-4.02.01-04	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2
2	Loam light loess-like, slightly plastic without impurities P. 35 «a» ShNK 4.02.01-01	0,2-1,2	0,2-1,2	0,2-1,2	0,2-1,2	0,2-1,0	0,2-1,0	0,2-1,0	0,2-1,0
3	Sandy loam								
4	Gypseous sand								
5	Weak marl limestone of medium strength p. 16 «b» ShNK 4.02.01-04.								
6	Gypsum b. 7 ShNK 4.02.01-04	1,2-1,8	1,2-1,8	1,2-1,8	1,2-1,8	1,0-1,4	1,0-1,4	1,0-1,4	1,0-1,4
7	Marl of low strength p. 24 «b» ShNK 4.02.01-04.	1,8-2,2	1,8-2,2	1,8-2,2	1,8-2,2	1,4-1,8	1,4-1,8	1,4-1,8	1,4-1,8
	Pit depth. m	2,2	2,2	2,2	2,2	1,8	1,8	1,8	1,8
	Groundwater level	-	-	-	-	-	-	-	-

№	Soil lithological description	Pit № 19 (100 m) from 1123 km right side				Pit № 20 (100 m) from 1127,6 km right side			
		p-1	p-2	p-3	p-4	p-1	p-2	p-3	p-4
1	Top soil p.9 «b» ShNK-4.02.01-04	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2
2	Loam light loess-like, slightly plastic without impurities P. 35 «a» ShNK 4.02.01-01	0,2-0,9	0,2-0,9	0,2-0,9	0,2-0,9	0,2-0,9	0,2-0,9	0,2-0,9	0,2-0,9
3	Sandy loam								
4	Gypseous sand	0,9-1,3	0,9-1,3	0,9-1,3	0,9-1,3	0,9-1,3	0,9-1,3	0,9-1,3	0,9-1,3
5	Weak marl limestone of medium strength p. 16 «b» ShNK 4.02.01-04.	1,3-1,5	1,3-1,5	1,3-1,5	1,3-1,5	1,3-1,5	1,3-1,5	1,3-1,5	1,3-1,5
6	Gypsum b. 7 ShNK 4.02.01-04	1,5-2,0	1,5-2,0	1,5-2,0	1,5-2,0				
7	Marl of low strength p. 24 «b» ShNK 4.02.01-04.	2,0-2,4	2,0-2,4	2,0-2,4	2,0-2,4	1,5-1,9	1,5-1,9	1,5-1,9	1,5-1,9
	Pit depth. m	2,4	2,4	2,4	2,4	1,9	1,9	1,9	1,9
	Groundwater level	-	-	-	-	-	-	-	-

№	Soil lithological description	Pit № 21 (100 m) from 1133 km right side				Pit № 22 (200 m) from 1145 km right side			
		p-1	p-2	p-3	p-4	p-1	p-2	p-3	p-4
1	Top soil p.9 «b» ShNK-4.02.01-04	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2
2	Loam light loess-like, slightly plastic without impurities P. 35 «a» ShNK 4.02.01-01	0,2-0,7	0,2-0,7	0,2-0,7	0,2-0,7	0,2-1,0	0,2-1,0	0,2-1,0	0,2-1,0
3	Sandy loam								
4	Gypseous sand					1,5-1,5	1,5-1,5	1,5-1,5	1,5-1,5
5	Weak marl limestone of medium strength p. 16 «b» ShNK 4.02.01-04.								
6	Gypsum b. 7 ShNK 4.02.01-04	0,7-1,2	0,7-1,2	0,7-1,2	0,7-1,2	1,5-1,9	1,5-1,9	1,5-1,9	1,5-1,9
7	Marl of low strength p. 24 «b» ShNK 4.02.01-04.	1,2-1,6	1,2-1,6	1,2-1,6	1,2-1,6	1,9-2,3	1,9-2,3	1,9-2,3	1,9-2,3
	Pit depth. m	1,6	1,6	1,6	1,6	2,3	2,3	2,3	2,3
	Groundwater level	-	-	-	-	-	-	-	-

№	Soil lithological description	Pit № 23 (200 m) from 1165,5 km right side				Pit № 24 (100 m) from 1171 km right side			
		p-1	p-2	p-3	p-4	p-1	p-2	p-3	p-4
1	Top soil p.9 «b» ShNK-4.02.01-04	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2
2	Loam light loess-like, slightly plastic without impurities P. 35 «a» ShNK 4.02.01-01	0,2-1,0	0,2-1,0	0,2-1,0	0,2-1,0	0,2-0,9	0,2-0,9	0,2-0,9	0,2-0,9
3	Sandy loam								
4	Gypseous sand	1,0-1,2	1,0-1,2	1,0-1,2	1,0-1,2				
5	Weak marl limestone of medium strength p. 16 «b» ShNK 4.02.01-04.	1,2-3,0	1,2-3,0	1,2-3,0	1,2-3,0	1,5-2,3	1,5-2,3	1,5-2,3	1,5-2,3
6	Gypsum b. 7 ShNK 4.02.01-04					0,9-1,5	0,9-1,5	0,9-1,5	0,9-1,5
7	Marl of low strength p. 24 «b» ShNK 4.02.01-04.								
	Pit depth. m	3,0	3,0	3,0	3,0	2,3	2,3	2,3	2,3
	Groundwater level	-	-	-	-	-	-	-	-

№	Soil lithological description	Pit № 25 (50 m) from 1191 km right side				Pit № 26 (50 m) from 1198,5 km left side			
		p-1	p-2	p-3	p-4	p-1	p-2	p-3	p-4
1	Top soil p.9 «b» ShNK-4.02.01-04	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2
2	Loam light loess-like, slightly plastic without impurities P. 35 «a»ShNK 4.02.01-01	0,2-0,7	0,2-0,7	0,2-0,7	0,2-0,7	0,2-0,5	0,2-0,5	0,2-0,5	0,2-0,5
3	Sandy loam								
4	Gypseous sand					0,5-1,3	0,5-1,3	0,5-1,3	0,5-1,3
5	Weak marl limestone of medium strength p. 16 «b» ShNK 4.02.01-04.	0,7-1,1	0,7-1,1	0,7-1,1	0,7-1,1				
6	Gypsum b. 7 ShNK 4.02.01-04	1,1-1,5	1,1-1,5	1,1-1,5	1,1-1,5	1,3-1,8	1,3-1,8	1,3-1,8	1,3-1,8
7	Marl of low strength p. 24 «b» ShNK 4.02.01-04.	1,5-2,0	1,5-2,0	1,5-2,0	1,5-2,0	1,8-2,2	1,8-2,2	1,8-2,2	1,8-2,2
	Pit depth. m	2,0	2,0	2,0	2,0	2,2	2,2	2,2	2,2
	Groundwater level	-	-	-	-	-	-	-	-

№	Soil lithological description	Pit № 27 (100 m) from 1201 km left side							
		p-1	p-2	p-3	p-4				
1	Top soil p.9 «b» ShNK-4.02.01-04	0,0-0,2	0,0-0,2	0,0-0,2	0,0-0,2				
2	Loam light loess-like, slightly plastic without impurities P. 35 «a»ShNK 4.02.01-01	0,2-1,5	0,2-1,5	0,2-1,5	0,2-1,5				
3	Sandy loam								
4	Gypseous sand								
5	Weak marl limestone of medium strength p. 16 «b» ShNK 4.02.01-04.	1,8-2,2	1,8-2,2	1,8-2,2	1,8-2,2				
6	Gypsum b. 7 ShNK 4.02.01-04	1,5-1,8	1,5-1,8	1,5-1,8	1,5-1,8				
7	Marl of low strength p. 24 «b» ShNK 4.02.01-04.								
	Pit depth. m	2,2	2,2	2,2	2,2				
	Groundwater level	-	-	-	-				

212. In addition, the following materials will be sourced:

- Cement concrete will be mixed in batching plants established by the contractor on site. The cement will be purchased from existing, licensed cement plants, transported by rail to the nearest railway station and then by road. Recently a new cement plant was opened in the Korauzyak district.
- Asphalt plants exist in Beruniy and Nukus, being too far away from the site to transport asphalt from there. Bitumen for the asphalt concrete at rest areas and access roads shall also be transported by rail to the nearest railway station.
- Reinforced concrete structures, support traffic signs and other concrete structures will be sourced from Tashkent plants of concrete products (average haulage distance by railway - 1035 km).
- Concrete culverts will also be sourced from Tashkent plants (average haulage distance by railway - 1035 km).
- Process water will be sourced from local sources (typically the railway stations).

213. There seem to be no sufficient sources of bitumen producing companies in the Uzbek Republic. However, for projects which are part of the investment program, the needed amount of bitumen will be provided under the state contingent by the concerned authorities. The same assumption shall be used for all bitumen-based products. In addition, the amount of bitumen is marginal, because only at rest areas and minor access roads asphalt concrete will be used.

G.4.7 Conclusion

214. Detailed geotechnical investigations were carried out in the course of the FS preparation. Existing conditions are satisfactory for the rehabilitation/reconstruction of the Karakalpakstan Road Project. Construction materials are available in the needed quantities and quality, although some of them have to be hauled over long distances by railway.

G.5 Road Inventory and Surface Condition Survey

G.5.1 Investigation Period

215. In the course of the elaboration of the FS documentation for the rehabilitation/reconstruction of the Karakalpakstan Road Project, inventory and survey works have been carried out in July 2016 based on IKN 05-11 "Guidelines for diagnostic and assessment of motor roads. They comprised the determination of layer thicknesses and composition as well as the type and percentage of defects of the road surface. Data of the road inventory and condition survey was handed over to the Consultant for the sections from km 964 to km 971 and from km 1181 to km 1204 on the existing A380.

G.5.2 Scope of Investigations

216. A visual inspection of the design road sections was carried out and defects were recorded per linear or square meter. Trial pits were sunk at approx. 500 m interval to determine the thickness of the pavement layers. Samples were taken and brought to a laboratory to determine the mechanical properties of each encountered material.

G.5.3 Results of Investigations

217. The works were carried out by RDI. An overview of the thicknesses of the detected layers and types and quantities of defects are given below.

Subsection from km 964 to km 971

- 40 to 110 mm thick bituminous gravel mix layer
- 140 to 560 mm thick bituminous gravel layer
- existing subsoil

218. Following defects were recorded in the first sub-section on existing A380 per km:

- Longitudinal cracks, average length 1349 m
- Transverse cracks, average length 1534 m
- Net cracks, average area 368 m²
- Depressions, average area 1.3 m²
- Corrugations, average area 8.1 m²
- Pitting, average area 1954 m²
- Raveling, average area 8.7 m²
- Potholes, average area 3.2 m²

Subsection from km 1181 to km 1204

- 30 to 120 mm thick bituminous gravel mix layer
- 100 to 450 mm thick bituminous gravel layer
- existing subsoil

219. In the second sub-section on existing A380 defects per km were recorded as follows:

- Longitudinal cracks, average length 1838 m
- Transverse cracks, average length 1796 m
- Net cracks, average area 1174 m²
- Corrugations, average area 4 m²
- Pitting, average area 1715 m²
- Raveling, average area 200 m²
- Potholes, average area 45 m²

220. In all of the sub-sections the bound layers do not correspond to GOST 9128-2009 and the unbound layers are only partially in line with GOST 25607-2009 with regard to the gradation.

221. Between the above-mentioned two pavement layers and the existing subsoil or embankment fill material, no further layers were detected. However, at one trial pit a further bound and unbound layer has been investigated. Based on the visual inspection and the numerous defects, it can be assessed, that the existing road pavement has reached the end of its useful life and a complete reconstruction of the pavement structure is needed.

G.5.4 Conclusion

222. The existing bituminous pavement in the sub-section from km 1181 to km 1204 has reached the end of its useful life. They shall be replaced by complete new cement concrete or asphalt pavement structures as per design of RDI. One of the reasons may be a lack of timely performance of road maintenance.

G.6 Pavement Design

G.6.1 Design Parameters

223. The design standards in force in Uzbekistan for non-rigid pavements is MKN 46-2013. For the design of rigid pavements MKN 44-2008 is in use. The latter guideline determines how the pavement structure has to be calculated depending on the road category, the number of lanes, the permissible axle load, the climatic zone and the forecast AADT. Further, it determines the minimum thickness of the cement concrete surface layer and the distance of transverse and lateral joints, at which dowels/anchors are placed. According to the traffic forecast for a 25-year design life and based on a 13-ton axle load, the minimum thickness of the cement

concrete surface layer accounts to 24 cm. The pavement design considers a 13-ton axle load. For carriageway widths over 6 m the maximum distance between transverse joints is 20 times the thickness and lateral joints have to be provided, if the carriageway is wider than 23 times the thickness of the cement concrete layer.

G.6.2 Proposed Pavement Structure

224. In accordance with the design, the pavement design takes into account the importance and function of the road, traffic, safety and economy, the availability of local building materials, climatic and soil-hydrological conditions and the conditions of operation and maintenance of the road. By the design solution, the pavement type chosen is in general a new cement concrete pavement with the exception of some minor access roads and the parking at rest areas, which will get a new asphalt concrete pavement. More details are given in the typical cross section drawings.
225. The existing bituminous pavement shall be cold-milled or scarified and recycled. Material obtained from removal of the existing pavement will be used as material for the gravel shoulders.
226. As per the DD documentation prepared by RDI the following new road pavement structure will be applied throughout the whole length of the project road:
- (i) cement concrete pavement with 25 cm thickness from sulfate resistant concrete mixture, by type M-400 (GOST 26633-12);
 - (ii) geotextile (debonding layer);
 - (iii) dry lean concrete base course layer M-75 with 16 cm thickness from gravel sand mixture treated with sulfate-resistant cement (according to GOST 23558-94);
 - (iv) sub-base course with thickness 37 cm from gravel sand mixture with addition of 30 % of scarified pavement (according to GOST 25607-09);
 - (v) geotextile (filter geosynthetic) on top of the new formation;
227. Parking spaces at rest areas shall have the following pavement on top of the mineral base course:
- (i) 6 cm wearing course of fine graded, dense asphalt type B class 1 (according to GOST 9128-2009);
 - (i) 10 cm bituminous binder of coarse graded, porous asphalt class 1 (according to GOST 9128-2009);
 - (ii) 46 cm aggregate base of gravel sand mix in two layers (according to GOST 23735-14);
228. The pavement structure of merging, stopping and turning lanes shall be identical to the pavement of the carriageway.
229. Strengthening of unpaved shoulders with 15 cm thickness shall be constructed by using gravel (aggregate) and sand mixture.

G.6.3 Calculations

230. Calculations of the proposed pavement structure were submitted to the consultant from the Tashkent Design Institute. They were prepared according to the local pavement design guidelines. In the absence of detailed axle load spectrum and/or Design MSA based on 80 KN standard axle load data, SHELADIA team undertook a verification of these calculations as well as a comparison using the Portland Cement Association (PCA) "Thickness Design for Concrete Highway and Street Pavements" (1984) and American Concrete Institute (ACI) "325.12R-02 guidelines" for the projected ADTT. Calculations indicate that the design concrete pavement thickness of 25 cm is adequate. Calculations of the national materials specialist according to the Uzbek pavement design guidelines resulted in a required thickness of the cement concrete layer of 25 cm, confirming the one chosen by RDI. Also, the German design guideline for standard pavement structures was consulted to compare the layer composition proposed by RDI.

G.6.4 Design Life

231. The design guideline for the calculation of rigid pavements in force in the Republic of Uzbekistan, MKN 44-2008, determines a minimum design life period of 25 years for cement concrete road pavements. This is in line with best international practice. A properly constructed cement concrete pavement should serve for a period of 25 to 30 years.

G.6.5 Comparison with common Practice and Conclusion

232. Cement concrete pavements are widely used in the road construction for heavy-duty roads all over the world. The construction technology used in Uzbekistan is similar to the common practice in Germany. The slabs are continuously cast by means of special pavers without reinforcement and dowels and anchors are placed at the locations of foreseen transverse and lateral joints. Technological gaps are foreseen at breaks of production. Immediately behind the paver, the surface gets the desired finish and a few hours later, when the concrete is strong enough, transverse and lateral joints are cut. Transverse joints shall have a depth of 25 to 30% of the slab thickness and lateral joints between 40 and 45% of the slab thickness. The surface has to be cured to prevent uncontrolled cracks due to creeping and shrinkage.
233. German guideline RStO 2012 determines the thickness of pavement structures depending on the design life load (10-ton ESAL). Based on the traffic data provided by RDI and considering a design life of 25 years, the load class "BK 10", standing for between 3.2 and 10 million 10-ton axle passes during the design life period was determined. The proposed cement concrete pavement structure for "BK 10" is as follows:
- Cement concrete surface layer, thickness 25 cm
 - Dry lean concrete base course layer, thickness 15 cm
 - Mineral sub-base, thickness 35 cm
234. The total thickness of the above shown pavement structures accounts to 75 cm, whilst the proposed one from DI accounts for 78 cm. Thus, it can be assessed, that the pavement design for the project road with proposed new cement pavement is in general adequate.
235. It was noted, that the required strength of the dry lean concrete base course layer shall correspond to M75 or B 5 according to GOST 26633-12. In international practice various values for the strength of the CTB are used, e.g. in Germany the required compressive strength for this layer is given as 15 N/mm² for a cylinder sample, thus being 20 N/mm² for cube samples. AustRoads suggest a minimum compressive strength of 5 MPa with an additional upper limit to shrinkage strain. FHWA limits the strength to between 750 to 1200 psi or 5 to 8.3 MPa. Therefore, the layer strength is assessed to be in the common range and the pavement structure calculations of RDI based on the given value result in a sufficient performance during the design life period.
236. Between the dry lean concrete base course layer and the cement concrete pavement a geotextile is foreseen in the design. This is in line with best international practice. The specifications for the project shall determine the requirements for the geotextile to be used.
237. A layout scheme for transverse and longitudinal joints is presented in the standard drawings. Anchors and dowels according to Uzbek regulations differ from best international practice with regard to the spacing between them. Proposed dowels have a diameter of 25 mm and are 50 cm long. At their whole length they are factory-coated with a polymer of minimum 0.3 mm thickness. The spacing between them is 0.50 m. Anchors have a length of 80 cm, a diameter of 20 mm and 3 nos. are placed in each slab. The middle 20 cm of the length are polymer coated. Every 80 m expansion joints are foreseen in which 50 cm long dowels of 25 mm diameter shall be placed at 30 cm interval.
238. The length and diameter of anchors and dowels are state of the art. However, in Germany dowels are placed at 50 cm interval at the inner meter of the right lane and at 25 cm interval at the remaining width of it. At the left lane the interval is 50 cm and thus the same as applied by RDI. The design shall strive for best international practice and apply the interval of dowels in the right lane accordingly. This will also enable a smooth construction process since most of the equipment used is purchased from Germany or the US.

239. The design proposes the use of joint fillers or prefabricated profiles for the sealing of joints. The width and depth of joints shall correspond to the proposed joint sealing material. While the widened part of the joint in the design of RDI meets the requirements of the German guidelines, the overall proposed joint depth of 60 mm for both, transversal and longitudinal joints, is not in line with the German standard. Transversal joints should have a depth of 25-30% of the slab thickness, i.e. 63-75 mm and longitudinal joints 40-45% of the slab thickness, i.e. 100-113 mm. The values in the German guideline consider that stress in the longitudinal joints is much less than in the transversal ones, but the crack in the concrete slab shall occur controlled also in the longitudinal joints.
240. Expansion joints as proposed by RDI are no longer used in Germany. Attention shall be paid that they are properly constructed and sealed. However, they may have the advantage to allow for bigger extension of the slabs in between during high temperatures in summer.
241. Asphalt concrete pavements will be applied for rest areas and access roads. No separate traffic forecast is available for them. For rest areas mainly used by passenger cars with a low percentage of heavy traffic, load classes "BK 0.3 to BK 1.8" are applicable. For "BK 1.0" the German RStO 2012 proposes the following asphalt pavement structure:
- AC wearing course, thickness 4 cm
 - AC binder course, thickness 14 cm
 - Mineral sub-base, thickness 37 cm
242. The total thickness of the above shown pavement structures accounts to 55 cm, whilst the proposed one from DI accounts for 62 cm. However, the German Standard foresees a total thickness of 18 cm for the asphalt layers, while the RDI design proposes 16 cm. On the other hand, the mineral layer according to RStO 2012 is 37 cm thick and RDI proposes 46 cm of unbound layers. Thus, it can be assessed, that the pavement design for the areas with proposed new asphalt pavement is in general adequate.

G.7 Hydrology and Drainage

G.7.1 Overview

243. The Project road does not cross any river. The nearest surface water features are the Chimboy lake and the Sudochoye lake, both of which are more than ten kilometers east and west respectively of the southern start point on the Project road. Neither of these surface waters are anticipated to be impacted by project works due to their distance from the road.

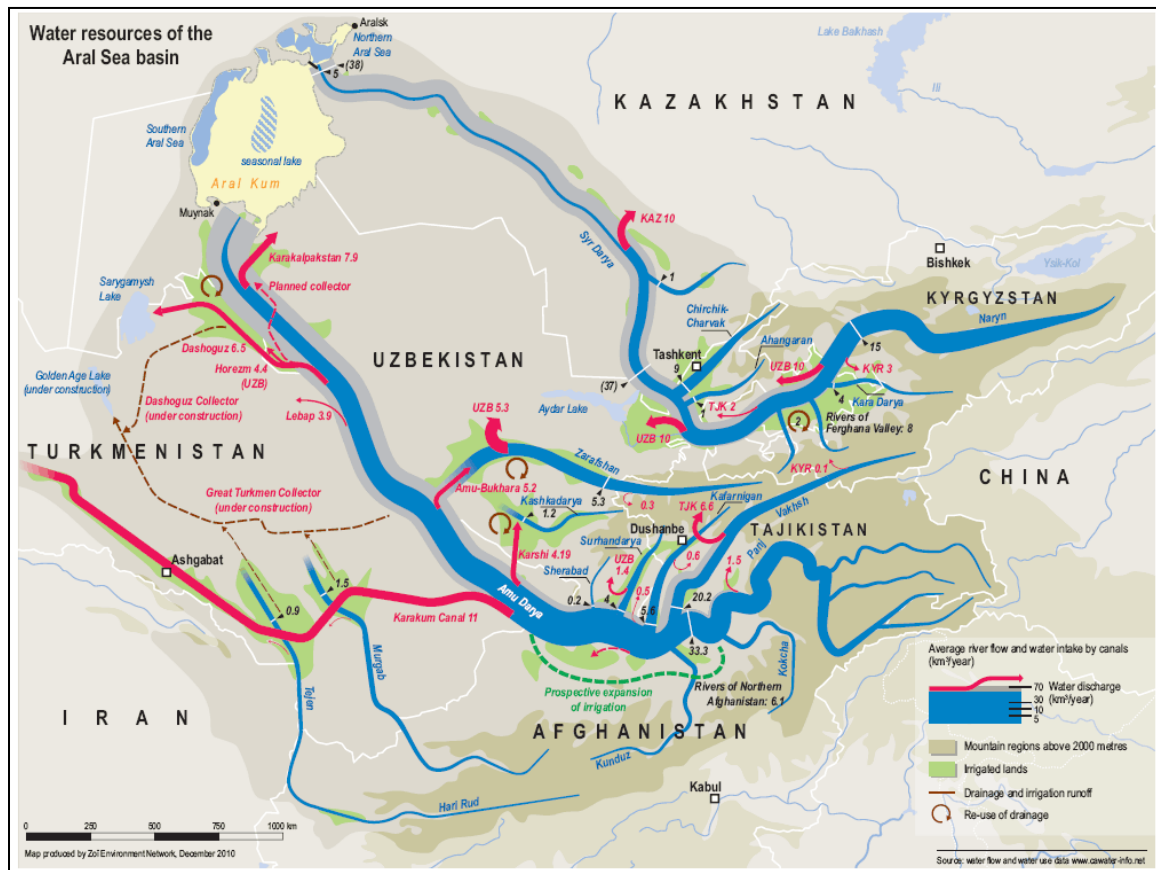


Figure 6: Regional Water Use¹⁴

244. Ground water in the Project area is highly saline (12 to 30 g/l¹⁵) and can be found at depths of 8-10 meters.¹⁶ Groundwater that is extracted for use (at depths of 80-90 meters) is usually processed through desalination plants, including those found in Takhtakupir (2400 m³/day) and five small plants in Muynak (15 m³/day each). Typically, however the groundwater in the northern part of the Ustyurt plateau is less saline than in the south as a result of the increased annual average recharge in the north.
245. According to the UNs Environmental Performance Review of Uzbekistan (2010) as a result of anthropogenic factors, the groundwater quality continues to deteriorate in some regions of the country, such as the Republic of Karakalpakstan and drinking water supply problems are very acute in Karakalpakstan.

G.7.2 Type, Number and Condition of existing Culverts

246. As part of the topographical survey the design institute recorded the location, dimensions, length and material of all existing pipes, crossing the design road sections, where the new alignment follows the existing road. Culverts in the existing A380 in sub-sections of realignment were not recorded, because they are not affected by the road project. More detailed information on the condition of the recorded culverts (defects, silting etc.), head and wing walls etc. was not made available to SHELADIA team. An overview of the number and types of existing culverts under the main road in the concerned sub-sections is given as follows:

- Metal pipes dia. 0.6 m - 7 nos.
- Metal pipes dia. 1.0 m - 5 nos.

¹⁴ <http://www.cawater-info.net/aral/i/vod-res-bam-e.gif>

¹⁵ <http://www.fao.org/docrep/006/Y4711E/y4711e05.htm>

¹⁶ The Aral Sea: The Devastation and Partial Rehabilitation of a Great Lake. Philip Micklin, Nikolay Aladin, Igor Plotniko. 2014

- Reinforced concrete pipes dia. 1.0 - 1 nos.

G.7.3 Proposals for Rehabilitation, Reconstruction and new Culverts

247. The new road level will in general be raised by 1-2 m. In combination with the applied embankment slope ratio of 1:4 (V:H), the width of the new formation will be more than 20.0 m. ShNK 2.05.03-11, "Bridges and pipes", requires a minimum diameter of 1.25 m for pipe lengths over 20 m. Thus, all of the existing pipes have to be replaced. In sub-sections of new alignment, pipe culverts of diameter 1.25 m are proposed as per local requirements too. Overall 40 nos. of reinforced concrete pipe culverts are included in the DD. The details of the location, length etc. are given in a table displayed on the relevant DD drawings.

G.7.4 Discharge Calculations

248. No discharge calculations were carried out by RDI as SHELADIA team was informed during a meeting at their office. The consultant understands that this is due to the lack of clear catchment areas, waterways and basins in the project area. The precise location of each proposed culvert is given in a table on the culvert drawings.

G.7.5 Flow Velocities

249. For the culverts no flow velocities have been calculated by the designer. Taking into account the mainly flat terrain and resulting little longitudinal slopes of the culverts, high flow velocities shall be no issue and scouring at culvert outlets is unlikely to occur. However, according to the culvert drawings of RDI for r/c pipe culverts, channels connecting the inlet and outlet of the culverts with retention basins, shall be constructed.

G.7.6 Consultants Review

250. Scope of the Review: The Consultant reviewed the design of the proposed culverts in the first 40 km section from km 964 to km 1004. SHELADIA Associates, Inc. (SAI) has performed detail H&H analysis for all four (4) circular culverts for its adequacy since design criteria, computations and methodology used in the design are not available.
251. Methodology Used for the Analysis: Karakalpakstan is considered to have a desert climate. The average annual temperature in this area is 9.1 °C. Maximum daily precipitation is 51.0 mm and yearly precipitation here averages at 145.8 mm. It has been found that the interior western United States, specially Nevada, has a midlatitude desert climate very similar to Uzbekistan. It is assumed that NRCS storm data for Las Vegas County, Nevada can be used for peak discharge computations in the project area due to its climate similarity. The determination of peak discharges for the respective return periods was undertaken by the NRCS method using WIN TR-20. Drainage area has been delineated based on the contours (0.5 m interval) obtained from Google Earth topographic map. Time of concentration is estimated assuming runoff velocity is very low (0.3m/sec) due to loamy desert soils and its extremely flat slope. Western Desert Urban Areas and HSG A were assumed as land cover and hydrologic soil group, respectively to select runoff number (CN) for peak discharge computations. In this study, the design flood was selected following AASHTO in absence of any local guidelines. Design flow was set to the peak discharge corresponds to maximum daily precipitation (51 mm) recorded in Karakalpakstan. Headwater depth and capacity computations of the culverts were performed using HY-8, version 7.50 (FHWA, 2016). The incipient overtopping flows were checked against the maximum daily flow. The culvert design has been considered adequate if max daily flow is less than the overtopping flow and HW/D is less than 1.5. The following Table summarizes the results of the H&H analyses.

Table 14: Results of Consultant's hydraulic analysis

Culvert	Hydrology					Hydraulics						
	Drainage	Time of	Discharges			INV IN	INV OUT	Length	Slope	Road Top	Overtopping	Headwater
Location	Area	concentration, Tc	25-yr	Qp	50-yr						Discharges	depth, HW
	(hectre)	(hr)	(cms)	(cms)	(cms)			(m)			(cms)	(m)
84+75	4974	12.0	1.9	2.6	3.7	148.97	148.93	26.1	0.15%	151.69	4.5	1.67
151+00	4547	12.0	1.7	2.4	3.3	141.59	141.55	22.1	0.18%	143.52	3.3	1.57
230+25	3318	12.0	1.3	1.7	2.4	132.98	132.94	22.1	0.18%	135.35	4.0	1.38
329+75	12878	12.0	4.9	6.7	9.5	105.13	105.07	22.1	0.27%	108.57	5.2	2.83
Note: Qp corresponds to daily maximum precipitation, 51 mm recorded at Karkalpakstan												
In similart climate and landcover (Nevada, USA), 25-yr precipitation = 48 mm. and 50-yr precipitation = 56 mm												
All peak discharges computed using NRCS method (Win TR-20)												

252. **Summary and Conclusion:** The highway will not be inundated at all four culvert locations from the stage of the 25-yr flow which corresponds to 48.3 mm of precipitation. Highway will be inundated at Station 329+75 from the stage of the daily maximum peak flow which corresponds to 51 mm of precipitation. All culverts except culvert at design chainage PK 329+75 satisfies the allowable headwater depth (HW/D < 1.5) criteria at design discharges. Outlet velocity has been addressed by scour pool at the outlet end, the purpose of the pool at the inlet end is not clear from the documents provided.

253. The results of the review were shared with the designer on June 3, 2019 and a request was made to consider the increase in pipe diameter to 1.50 m at design chainage PK 329+75 in case overtopping is not acceptable at 25 year return period as per Uzbek design guidelines. Otherwise no actions need to be taken.

G.7.7 Recommendations and Final List of Culverts with Details

254. The culvert list shown in the Appendix shall be taken as final. The proposed culverts are displayed in the plan drawings with the main features like diameter, material, chainage and length. This will enable bidders to precisely estimate the cost of construction for each of the culverts. However, it would be helpful to add the culvert number in line with the table of culverts for an easier correlation between the drawings and the table.

255. Culverts under access roads are not foreseen in the design.

G.7.8 Culvert Drawings

256. RDI prepared a standard drawing for a r/c pipe culvert dia 1.25 m, but also particular drawings for each culvert, showing invert levels at in- and outlet and other geometrical parameters. They are in line with the standards elaborated for pipe culverts in Uzbekistan. Tables in the drawings display the needed amounts of concrete and reinforcement steel for each pipe, the head and wing walls as well as for the strengthening of in- and outlets. Volumes of earthworks are calculated too. Plan sketches on the culvert drawings show the location of each culvert. The arrangement of retention basins and channels to the in- and outlets of the culverts is presented on separate drawings.

G.7.9 Conclusion

257. The design of culverts is assessed to be detailed and adequate for the implementation of the project.

G.8 Bridges

258. Neither an existing bridge was detected in the project road nor is a new one foreseen in the design alignment.

G.9 Road Design

G.9.1 Design Standard in Force

259. Designs should be justified economically and the optimum choice will vary with regard to construction and road user costs. Construction costs will be related to terrain type and choice of pavement construction, whereas road user costs will be related to level and composition of traffic, journey time, vehicle operation and road accident costs.
260. The criteria for road capacity and geometry used for the design have been taken from ShNK 2.05.02-07 (Road and Highway Design). These criteria are generally based on the earlier former Soviet Union SNIP standards, but provisions have been made to adapt them to a certain extent to the concrete needs of Uzbekistan. However, many of the geometrical design parameters are the same.
261. Since the last edition of the former Soviet Union SNIP for road design was introduced in 1984, this standard is not in keeping with the times and modern developments and practices are not considered. The manual classifies conventional highways in terms of level of service or traffic volume, the categories used being I, II, III and IV.
262. Design speeds and the resulting geometric road characteristics according to ShNK 2.05.02-07 are slightly higher than in Western Europe or North America for certain parameters. This indicates a lesser consideration given to economic justification at the design stage and makes these standards expensive.
263. However, the geometric standards that were used by the Design Institute for implementation under the Project are based on ShNK 2.05.02-07 in accordance with the Terms of Reference. The main horizontal and vertical alignment parameters of the standard are summarized below.

G.9.2 Geometrical Design Parameters

264. For Karakalpakstan Road Project, the standards for the respective road category according to ShNK 2.05.02-07 were applied. The main design parameters for the related category are shown in the following table:

Table 15: Main design parameters for Category II Road

Design element	Minimum values		
	120 km/h	100 km/h	60 km/h
Min. radius	800 (600) m	600 (400) m	150 (125) m
Max. gradient	4 %	5 %	7 %
Min. crest curve	15,000 m	10,000 m	2,500 m
Min. sag curve	5,000 (2,500) m	3,000 (1,500) m	1,500 (600) m

Note: Values in brackets are allowed in mountainous terrain

265. Although the general design speed for the road sections is given with 120 km/h, at the approaches to the police control station at km ca. 220 and the BCP at the end of the project road, it is locally limited as deemed necessary for safe operation subsequently to a minimum of 20 km/h respectively 60 km/h. There is another existing police control point at km ca 85+250, just behind a junction. As RDI informed the Consultant, this police control point will be suspended and no speed limits are proposed at this location.

G.9.3 Transition Curves

266. Transition curves were introduced between straight alignment sections and circular curves or between two circular curves of significantly different radii. The transition curves conforming to ShNK 2.05.02-07 were used. In comparison to international best practice, the guideline is not flexible to optimal take into account the existing situation, since the length of transition curves

just depends on the horizontal radius. Such practice sometimes may lead to very short horizontal curves with long transitions and as such in case of applied superelevation to an unsteady riding and less comfort. Anyway, thanks to the chosen horizontal alignment, the Karakalpakstan Road Project avoids these shortcomings.

Table 16: Length of transition curves

Radius of horizontal curve, m	30	50	60	80	100	150	200	250	300	400	500	600 - 1000	1000 - 2000
Length of transition curve, m	30	35	40	45	50	60	70	80	90	100	110	120	100

G.9.4 Widening of curves

267. According to the ShNK 2.05.02-07 curve widening is required if the curve radius less is than 1.000 m. The recommended widening amount depends on the distance between the front bumper and the rear axle of a vehicle. For such distance less than 7 m for cars and less than 11 m for trucks, the values are shown below:

Table 17: Curve Widening

Radius (m)	850	650	575	425	325	225	140	95	80	70	60	50	40	30
Widening amount W (m)	-	0.4	0.5	0.5	0.6	0.8	0.9	1.1	1.2	1.3	1.4	1.5	1.8	2.2

Source: Road Standard 2.05.02-85 (SNIP)

268. On simple curves, widening runoff is applied over the superelevation runoff length and wholly on the inside edge. On the transition curves widening runoff is applied over the transition length. In all cases the guiding line marking should be placed half way between the edges of the widened carriageway. However, it shall be noted that the values given above are on the high side in comparison to international best practice. For example, German standards consider curve widening only for radii less than 200 m. Nevertheless, applying a minimum horizontal radius of 800 m, curve widening is not required in the project road.

G.9.5 Cross Section Parameters

269. The width of road on the one hand should be minimized so as to reduce the cost of construction and maintenance whilst on the other hand it shall be sufficient to carry the traffic loading efficiently and that vehicles in opposing directions of travel can pass safely. The width of road is composed of the width of carriageway (sum of the width of lanes) and the width of the shoulders. According to design prepared by RDI the design road shall comply with a category II road according to ShNK 2.05.02-07. The main parameters for various cases are shown in the figures below:

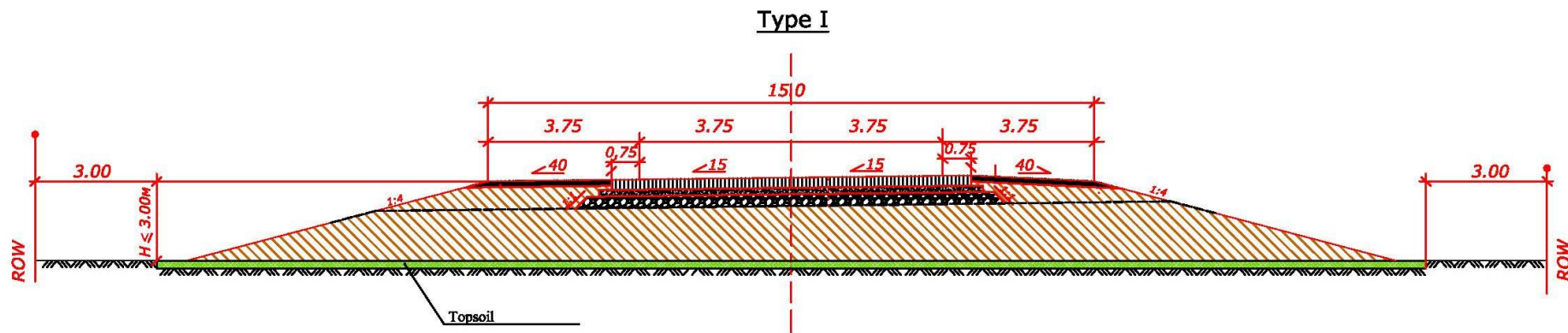


Figure 7: Typical cross section applied for new construction.

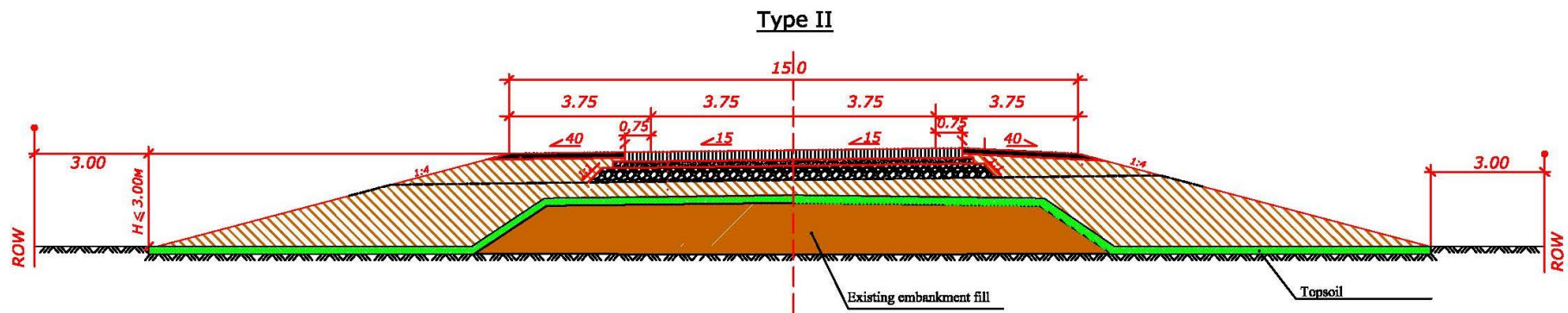


Figure 8: Typical cross section applied on existing earth road fill.



270. 5 types of typical cross section were developed by RDI. All of them are for sections located outside settlements since the road does not pass urban areas. Cross sections type 1 to type 3 have the same geometrical parameters of a category II road with 2 lanes. They differ with regard to the location of the road alignment on barren land, on top of the existing embankment fill of the abandoned earth road or on top of the existing A380. Geometrical parameters applied are as follows:
- Type 1 to type 3 with cement concrete pavement outside urban areas. LHS: 3.00 m unpaved shoulder, 0.75 m paved shoulder, 3.75 m carriageway. RHS: mirror image of LHS
271. The FS documentations does have a Cross section type 4 developed for application at the police control points near Jasliq and Karakalpakiya settlements. At the approaches to the control points the cross section will be widened to accommodate 2 lanes per direction. Geometrical parameters applied are as follows:
- Type 4 with cement concrete pavement outside urban areas including metal guardrail at median. LHS: 3.00 m unpaved shoulder, 0.75 m paved shoulder, 2 x 3.75 m carriageway, 1.0 m paved safety strip at median, 0.4 m half width of median. RHS: mirror image of LHS
272. For the approach to the BCP at the end of the project road, cross section type 5 was developed. Three lanes in direction to Kazakhstan are proposed while coming from Kazakhstan 1 lane was applied in the design. Cross section elements are as follows:
- Type 5 with cement concrete pavement outside urban areas including metal guardrail at median. LHS: 3.00 m unpaved shoulder, 0.75 m paved shoulder, 3.75 m carriageway, 1.0 m paved safety strip at median, 0.4 m half width of median. RHS: 0.4 m half width of median, 1.0 m paved safety strip at median, 3 x 3.75 m carriageway, 0.75 m paved shoulder, 3.00 m unpaved shoulder
273. The DD documentations does not fully indicate, e.g. in form of a table, in which design sections each of the cross sections above will be applied. This information shall be added in the cross-section drawings. No separate typical cross sections are included for the approaches to rest areas and junctions, where the road will be widened to add acceleration/deceleration or turning lanes, but this information is provided in the typical junction and junction layout drawings. It can be assessed that the cross sections are in line with the design standard and appropriate to accommodate future traffic.
274. In sections where the project road follows the existing A380, the existing bituminous pavement layers will be removed and mixed with fresh aggregates to be used for the strengthening of the unpaved shoulders. Topsoil at formation line width where the design alignment follows the abandoned earth road will also be removed on top of the existing fill, as applicable.

G.9.6 Cross Fall

275. Table 11 of ShNK 2.05.02-07 determines the cross fall parameters for roads as follows:

Table 18: Cross fall depending on road category

Road category	Cross fall, ‰
I:	
a) camber profile of each carriageway	15
b) straight cross fall to one side:	
first and second lane from median	15
third and further lanes	20
II-IV	15

Remark: On gravel roads a cross fall of 25-30 ‰ shall be applied, on earth roads, paved with local materials, and on plaster and cobble pavements -30-40 ‰.

276. The values given in the table above consider the relatively little average yearly precipitation in Uzbekistan. However, they are not in line with the former soviet standard (SNIP), which provides for a minimum cross fall of 20 ‰ and international best practice, e.g. in Germany the

minimum cross fall is applied as 25 %. Although the yearly average precipitation is little, road safety depending on a proper drainage is related to the single rainfall event. Rutting on cement concrete surfaces usually is not an issue, however the minimum cross fall value shall be sufficient to tolerate construction tolerances etc. Thus, the consultant considers the values given in ShNK 2.05.02-07 as too little and proposes RDI to reconsider them.

277. A cross slope to one side was applied in the DD by RDI, considering already a possible future upgrading to a category I road with 4 traffic lanes and a dual carriageway. While this solution is the standard for dual carriageway roads, SHELADIA team assesses that based on the traffic forecast the pavement will reach the end of its useful life before the need for the construction of the second carriageway arises. In addition, the median at recently reconstructed sections of A380 highway is very wide, allowing even for a ditch in the median. Considering the proposed cross fall of only 15 %, a shorter way of surface water to be discharged may increase road safety and RDI was informed to reconsider the applied one side cross slope.

G.9.7 Deviation from Standard

278. The proposed design values of the geometric design standards are usually intended to provide guidance for the design rather than to be considered as rigid minima. It should be realized that information and values presented in the design guidelines are considered as a 'design standard', but more appropriately described as good engineering practice that should be strived to achieve. But the justification for construction of a particular road will always be based on a detailed technical and economic appraisal, and relaxations of standards may be essential in order to achieve an acceptable level of return on investment. However, safety implication of a substandard road section needs serious consideration.
279. The project road passes through flat terrain with mostly easy local conditions. The desired horizontal design parameter for a category II road can fully be maintained at the whole length of the design section. Also, the longitudinal slope applied meets the provisions of the design guideline. Contrary to have difficulties with steep longitudinal slopes, at numerous sections they are less than 3 %. Therefore, surface water in case of rain needs to be discharged by the cross slope towards the road edge. This fact adds to the proposal of the Consultant to deviate from the applied cross fall.

G.9.8 Junctions

280. There is a number of major junctions in the project road, mainly linking the railway stations to it. They have been designed according to local standard and the layout drawings for them are contained in the DD of RDI. Separate drawings for junctions were submitted to the Consultant as part of the DD drawings from April 24, 2019. They address the earlier comment that the crossing angle and layout of a number of junctions are not appropriate. The re-connection of existing minor road to the section to be paved under the project will have a gravel surface and can easily be adjusted.
281. Most of the major junctions are assessed to be oversized. Turning traffic is very little, because the minor roads do not lead to any settlements except the ones to Jasliq and Karakalpakiya. It is not clear why the crossings of the existing minor roads were designed as cross roads where the project road is located between the railway line and the existing A380. After opening for traffic of the project road, the connections to the existing A380 on the right will no longer be required. Therefore, the junction layout was assessed to be not appropriate. In the latest DD drawings made available by the designer, this comment of the Consultant is not addressed. The junction layout may be revised by the site supervision team before the works are being executed.
282. As per international best practice separate right turning lanes are foreseen, if there is substantial right turning movement, what is not the case in the 240 km section. A short exit wedge for right turns will be sufficient.
283. A number of existing accesses to private property or filling stations were not taken into account in the layout of plan drawings. RDI shall make sure that all access roads, which are functional, will be properly shown in the plan drawings.

284. The major junctions included in the plan drawings are shown in the following table.

Table 19: Major junctions in ADB sections

Chainage	Type of Junction
A380, km 964 to km 1204	
km 0.769	Cross Road
km 1.877	Cross Road
km 5.194	Cross Road
km 8.969	T-Junction
km 37.484	Cross Road
km 43.678	Cross Road
km 66.168	Cross Road
km 85.221	Cross Road
km 109.562	T-Junction
km 134.222	Cross Road
km 156.269	Cross Road
km 180.360	Cross Road
km 196.493	Cross Road
km 198.825	T-Junction
km 198.970	T-Junction
km 201.149	Cross Road
km 219.760	T-Junction
km 236.211	T-Junction
km 239.627	T-Junction

G.9.9 Railway Level Crossing

285. At km 85+587.02 the project road crosses a branch from the main railway track to the Kazakh border. It only connects to a restricted area and ends after ca. 4.6 km from the level crossing. The number of trains per month is very limited. RDI achieved consent from the railway authority that a grade separated railway crossing by means of a structure is not required. The profile drawing shall clearly indicate the location of the level crossing and match the level of the rails.
286. The level crossing is located not far behind a junction. Additional lanes are proposed for turning movements and acceleration of vehicles turning into the main road. The road cross sections widened to 4 lanes crosses the railway line, although the distance between the junction and the level crossing would be sufficient to accommodate the required transition length and length of full 4-lane width in between. Due to road safety reasons the layout of the widening at the junction shall be amended.
287. Paving works in front and behind the level crossing at certain length cannot be carried out by means of a concrete paver due to technological reasons. Also, the slab arrangement has to be adjusted to provide the joints aligned with the rails. A separate drawing for the slab arrangement shall be contained in the DD documentation, also showing the transition to the standard slab length, if required.
288. The detail design drawings for the construction of the pavement at the railway level crossing as well as marking and signing were prepared by a specialized sub-consultant of RDI. They display all details required for the construction of it. However, it shall be noted that they are only in Russian and need to be translated into English to enable international bidders to understand them.

G.9.10 Bus Stops, Short term Parking (Rest Areas), Street Lighting and Road Furniture

289. Although no settlements are passed by the project road, bus stops on each side at the junctions to Jasliq and Karakalpakiya shall be considered.
290. According to the documentation of RDI, street lighting is foreseen at the railway level crossing, the police control point, the approach to the BCP and at rest areas. Details about the type and layout of the street lighting is provided in the relevant drawings. Since the project road is quite remote from bigger settlements with power supply and power plants as well, it was decided to use solar-powered lamps with twilight switches.
291. 8 nos. of rest areas are foreseen in the design as per standard drawings, alternating on one side of the project road. The proposed location of them was taken from the plan drawings as presented in the next table.

Table 20: Proposed location of rest areas

Chainage	Side of project road
A380, km 964 to km 1204	
km 19.661	RHS
km 39.742	LHS
km 99.662	RHS
km 121.340	LHS
km 140.180	RHS
km 160.340	LHS
km 179.660	RHS
km 199.742	LHS

G.9.11 Road Safety, Signs and marking Plans

292. The Team Leader visited the project site on November 22, 2018. Since no settlements are located along the project alignment and no major roads cross it, it was decided that the road safety audit of the international road safety specialist can be undertaken based on the drawings prepared by RDI and a check of the alignment in Google Earth at home office. During the 2016 PPTA he had visited Uzbekistan. His tasks included review of existing road safety standards and guidelines and the review of some of the earlier road safety studies carried out for Uzbekistan. Thus, the road safety specialist is familiar with the national standards and guidelines applied.
293. This Road Safety Report includes information on the road safety engineering aspects of the existing Project Road Corridor (km 964 to km 1,204 on A380) with a total length of 240 km, looking at alignment, junctions, traffic signs, road markings etc. Findings from the Road Safety Audit (RSA) of the available design drawings for the Karakalpakstan Road Project are presented in this separate report, which forms Appendix 7 to this report.

G.9.12 Utility Lines

294. Existing utility lines like water, electricity and telephone services within the road reservation were surveyed as part of the topographical survey by the involved enterprises. These are marked on the drawings as lines and posts. Information of underground utilities is marked as received from the suppliers and measured poles. Relocation measures needed for the reconstruction of the design road sections are contained in the design.
295. Relocation drawings for gas pipelines at various locations and for various diameters, prepared by a specialized sub-consultant of RDI, were made available to SHELADIA team. They contain the required information to carry out the works, but are again only in Russian and shall be translated.

296. Plan drawings for the relocation of gas and water pipelines as well as overhead power lines and the installation of water meters at the railway stations are included in the set of submitted drawings. However, no detail drawings for the placement of protective pipes for communication cables and water pipelines and the installation of street lighting at the police control and border crossing points were submitted yet. RDI shall make sure that they are included in the tender drawings. However, items for all the works to be carried out to relocate/construct the aforementioned items are contained in the BOQ.

G.9.13 Traffic Management under Construction

297. Traffic diversion during construction has to be considered carefully, because in the sub-sections where the project alignment follows the existing A380 the works may impact the passing traffic. To avoid any adverse impact of the works to the traffic, RDI has proposed temporary diversions in the sections from km 0.0 to km ca. 4.2, from km ca. 5.3 to km ca. 9.5, from km ca. 79 to km ca. 110 and from km ca. 219 to km 240. Traffic will be shifted to the temporary diversions during construction and thus bypass the sites.
298. Traffic shifting is one of the least disruptive work zone strategies since the same number of lanes are retained and narrow lanes or gravel surfaces, while reducing speed, have minimal effect on capacity. Utilization of the diversion for traffic in order to maintain the same number of lanes requires that the pavement of the diversion is able to adequately support anticipated traffic loads. Re-gravelling and sealing of the traffic lanes are required to sustain the traffic load during construction and permit the safe movement of traffic at a reasonable speed. Adequate signing must be provided to guide drivers to the temporary diversions.
299. The volume of works to construct the temporary diversions is included in the BoQ. Plan and profile drawings, cross section drawings and marking and signing drawings for the diversions were also be prepared. For all above-mentioned sub-sections, these drawings were submitted to SHELADIA team. They are assessed to be fit for purpose and enable the contractor to appropriately price the works during bid preparation. Traffic management is considered in a section of the general specifications as well.

G.9.14 Plan and Profile Drawings

300. Plan and Profile drawing were prepared by RDI by the use of software like CREDO and INDORCAD. This software is widely used in former CIS countries and is considered to be modern. Drawings can be prepared according to the user's needs. Whilst profile drawings are considered to be to sufficient detail to enable bidders and contractors to prepare proposals respectively carry out the works, plan drawings contain not all of the desired information. On the other hand, it should be noted that in comparison to the DD drawings submitted by RDI for the Kashkadarya road sections in 2016, plan drawings have improved and display more details. Geometric parameters of the horizontal alignment are presented in tables on the plan drawing, if horizontal curves are located in the concerned drawing. A separate table presents the details of benchmarks related to the shown road section.
301. However, the details listed below are not shown on the plan drawings:
- North arrow and coordinate grid
 - Side drains
 - Street lighting
302. The layout of some plan drawings, e.g. the number and arrangement of viewports, lacks good judgement. Viewports overlap each other, intrude into the inner drawing frame or are simply too many on one sheet. This leads to an overloaded impression of the plan drawings and complicates reading them. Detailed findings of the review of the set of DD drawings received in electronic format by end of December 2018 and in January 2019 are contained in Appendix 6. They were shared with RDI on February 14, 2019. However, in the final DD drawings submitted in April, the comments of the Consultant related to the layout seem to be not addressed.

G.9.15 Conclusion and Recommendations

303. Based on the DD drawing set made available to the Consultant, it is assessed that the road design is appropriate to implement the Karakalpakstan Road Project. In comparison with the DD documentation of the Kashkadarya road sections prepared by RDI in 2016, the quality and content of drawings has improved. However, further improvements in the quality of design drawings shall be made as proposed by SHELADIA team in Appendix 6.

G.10 Bills of Quantities and Project Costing

G.10.1 Review of BoQ

304. The Consultant received the BOQ for the sub-section from km 0 to km 40 by end of February, 2019. It is based on the standard form elaborated jointly by the individual consultant and RDI in 2016 and follows international practice. After a first review, the Consultant shared a few minor comments with RDI to be incorporated and considered in the BOQ of the remaining 5 lots as well. The full set of BOQ's for all 6 lots was submitted on March 14, 2019.
305. BOQ's are structured in line with the divisions of the technical specifications. They provide a short description of the work item and shall be read in conjunction with the drawings and specifications. A detailed description of the works included in each item is given in the specifications, which often refer to the drawings. As such, the scope of works is clearly specified, although the cross-references require to concurrently read all these documents for full understanding of the scope of works.
306. The methods of measurement given in the specification are in line with the BOQ units. The consultant checked the quantities of main items contained in the BOQ. They turned out to be reasonable and as such, the BOQ's are considered to be fit for purpose.
307. On July 9, 2019, the Consultant received further revised, final BoQs for all 6 lots. It was noted, that the comments contained in the design review report, are not properly addressed. Therefore, the findings of the previous detailed review of them are attached as Appendix 7 to this report.

G.10.2 Review of Costing

308. Cost estimates for all lots were made available to the Consultant on March 19, 2019. They are prepared as per national standard and in the local currency. The Consultant's review resulted in the following:
- The cost estimates are based on resources required to carry out a certain part of the works. For example, one sheet lists the labor, equipment, transport and materials to construct all pipe culverts for the concerned lot. This is not in line with the structure of the BOQ.
 - To the sum of the aforementioned expenses a surcharge for miscellaneous construction cost (0.83%), for other expenses of the contractor (24.25%), insurance (0.32%) and contractor's risk (6.0%) is added.
 - VAT gets added in the amount of 20%.
 - Although there is a separate sheet for preparational works, it does not cover all the general items as per international standard, e.g. provision and maintenance of Contractor's accommodation and vehicles.
 - No physical contingencies are considered in the cost estimates submitted by RDI, because this is not in line with the national standard.
309. Currently the bid evaluation of two road construction projects, financed by ADB, was completed. However, the contracts have not yet been awarded and therefore the bid evaluation reports cannot be made available to the consultant. Thus, based on the BOQ's, own cost estimates prepared in 2016 and experience in similar projects in CIS countries, SHELADIA prepared own cost estimates for all lots. The overall cost estimate of RDI as of March without VAT is about 91% of the cost estimate of the Consultant without dayworks,

VAT and contingencies. Thus, the cost estimates of RDI are well in the common range of $\pm 10\%$, although the deviation is to the low side.

310. In July 2019 the Consultant received the financial part of the FS prepared by RDI. Obviously, in comparison to the March cost estimates, an updated exchange rate was used for the conversion of UZS into US\$. That's why the US\$ amount of July is slightly less than the one of March. Also, the financial part of the FS considers physical contingencies of 10% of the civil works costs. A split for each lot is not provided. Due to the updated exchange rate the cost estimate of RDI is 89.4% of the one of the Consultant, being slightly out of the $\pm 10\%$ range.
311. RDI again updated the financial part of the FS in September 2019, addressing comments from the Ministry of Finance, i.e. to reduce the percentage for other expenses from 24.25% to 20.75% and to reduce the costs for materials. In addition, the cost estimate in US\$ was again revised, using the exchange rate of September 10, 2019. This led to a further substantial reduction in the civil works cost.
312. The overall cost estimated by RDI as of September 2019, amounts to m222.72 US\$ without physical contingencies and VAT. Without dayworks, the Consultant assesses the civil works cost at about m328.63US\$. With the addition of 5% for physical contingencies, the overall cost is estimated as approx. m345.06US\$. Considering the proposed implementation in 24 months, price escalation is taken into account in the amount of 5% as well. The sums of cost estimates for each lot prepared by RDI and the ones prepared by the Consultant are shown in the next table.

Table 21: Cost estimates of RDI and the Consultant

Cost without contingencies and VAT US\$		
	RDI	Consultant
Sub-Total	222,723,937	328,625,915
Contingencies (5% physical and 5% price)	22,272,394	32,862,591
Total	244,996,331	361,488,506

313. Since no unit rates of current road projects financed by international funding institutes are available, the Consultant applied those from similar international road projects. They may partially be not appropriate for Uzbekistan. For example, fill material for embankment construction does not need to be purchased, but will be provided at no cost at pits along the road. Therefore, only costs for the works to construct the new embankment need to be considered. This may explain the substantial difference in the cost estimates of RDI and the Consultant. Another reason is, that the cost estimate of the designer was prepared in UZS and then converted to US\$. The exchange rate is being updated every week and the value of the UZS dropped by about 9% in the period from March to September 2019.

G.11 Technical Specifications

G.11.1 Review of Technical Specifications

314. The consultant received and reviewed the technical specifications, which are based on the standard specifications developed jointly by the individual consultant and RDI in 2016. They have also been used in the recent tenders. Construction works in Uzbekistan have to be carried out in accordance to norms and regulations in force, such as:

ShNK	Civil Engineering and Architecture Standards (Technical Standard applied widely in Uzbekistan)
GOST	National State Standards (Technical Standard applied widely in Uzbekistan)
OST	Sector Specifications applied for reinstallations of communications facilities
MShN	Road Sector Norms and Standards (Technical Standard applied widely in Uzbekistan)

315. They were amplified by international standards as follows:

AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
ASTM	American Society of Testing and Materials
BS	British Standard

316. SHELDIA team had reviewed these specifications in 2016 and comments made are incorporated in the current document. The draft technical specifications along with the special specifications for the project were forwarded to the consultant by the RDI on March 12, 2019. The consultant is presently reviewing the specifications with regard to the BOQ and design documents. The review so far indicates, that only minor modifications to the draft specifications are required. A consolidated list of recommended modifications/additions would be communicated to RDI in due course.

G.11.2 Update of Technical Specifications for the Project

317. Specific specifications to add to or supersede particular items in the standard specifications were developed by RDI team according to the special needs of the project, taking into account lessons learnt in previous projects. They form part of the bidding documents.

G.11.3 Conclusion

318. The application of the Standard Specifications as developed by RDI is assessed to be appropriate for the project. They are accomplished by Specific Specifications to address the particular requirements of the project.

G.12 Preliminary Project Implementation Plan

G.12.1 Construction Scheduling

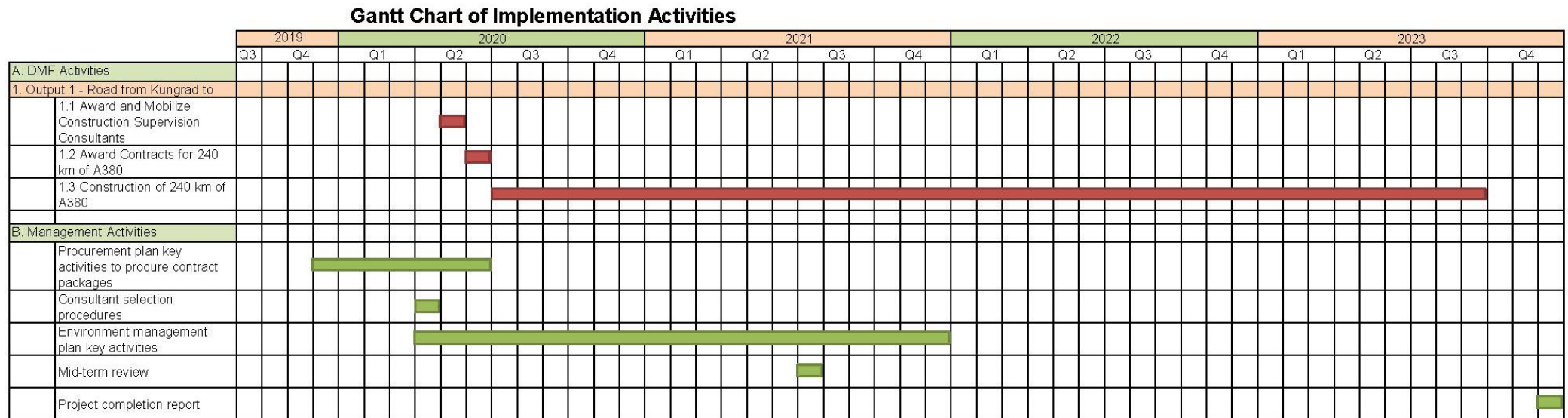
319. The works are scheduled to start in the third quarter of 2020. It was agreed between CR and ADB to split the 240 km project road length on A380 into 6 lots, each forty km long. Two separate contract packages are proposed for implementation, each of it comprising 3 lots. The first package comprises the 40 km long sections from km 964 to km 1,004 as lot 1, from km 1,004 to km 1,044 as lot 2 and from km 1,044 to km 1,084 as lot 3. It shall be contracted as CW-01. Under CW-02 the section from km 1,084 to km 1,124 forms lot 1, from km 1,124 to km 1,164 lot 2 and from km 1,184 to km 1,204 lot 3. Also, all lots will have a similar volume of works. In coordination with PMU, it was decided to implement the civil works for each of the lots in 24 months from the award of the contract.

G.12.2 Project Implementation Plan

320. The civil works for the construction of the 240 km road section from km 964 to km 1,204 on A380 shall be implemented as shown in the figure below. It considers the climatic conditions in the project region, allowing only for a limited construction season each year.

Table 22: Gantt Chart of Implementation Activities

Overall Project Implementation Plan



H. Economic and Financial Analysis

H.1 General

321. The project road proposed for improvement is a 240 km long section of A380, extending from Kungrad at km 964, to Daut-Ata (km 1204) at the border with Kazakhstan. This important international road and trade route is located entirely within the Kungrad district of the Karakalpakstan Republic of Uzbekistan. The total population of Kungrad district is 127,000, which has a land area of 76,000 sq.km. The population density is thus a very low of 1.7 persons per sq.km and it is even lower along the project road. Therefore, share of local traffic on the project road is very low. The road serves primarily long-distance international traffic of freight and passengers between Uzbekistan and through Kazakhstan with Russia and countries northwest and west of Uzbekistan, including those west of the Caspian Sea.
322. There is large investment potential in the Republic of Karakalpakstan and the gross regional product growth of Karakalpakstan of 10% per annum between 2010 and 2016 was primarily driven by industrial development and as a result, manufacturing's share in the Karakalpak economy grew from 14.6% in 2010 to 25.7% in 2016¹⁷. The report states that the regions industrial development will be driven by development of hydrocarbon deposits, metal mining and smelting projects, cement and vermiculite and several chemical manufacturing. Five large-scale projects are to be implemented in upcoming years, with a total worth of over 3.4 billion USD, in Karakalpakstan's hydrocarbon, energy and mining sectors. The project road corridor provides the primary road connectivity to the region and is one of the main trade corridors for Uzbekistan and thus an important component in realizing the development potential of the Republic of Karakalpakstan and the country.
323. The project road currently has a two-lane carriageway, one in each direction. The projected traffic levels on the project road indicate the requirement for a standard two-lane carriageway. The project road has mostly bituminous surfacing. The condition of the existing road pavement is unsatisfactory. On major sections, there are continuous cracks, potholes, rutting, ravelling, edge deterioration etc. In some sub-sections totalling about 40% of the length, the road has deteriorated to a gravel road standard. The poor pavement structure has resulted in road roughness well above desirable levels thus requiring pavement reconstruction.
324. Without the project, the road is expected to remain in poor condition, which will worsen over time. Maintenance will involve crack sealing, patching of damaged areas to the extent budget is made available and with the poor road structure and large heavy truck traffic, the road deterioration will be faster without reconstruction. With the project, the road will be upgraded to a 2-lane carriageway with cement concrete pavement and improved roadway design features and road safety features and roadside facilities. Currently there are very limited facilities for road users in this long road section and the proposed project is adding rest areas every 40 km. An economic analysis of proposed improvement of project road was undertaken using HDM-4 model for estimating the costs and benefits associated with both without and with the project scenarios.

H.2 Economic Costs

325. The economic costs of the project comprise (i) capital investment, which includes civil works, land acquisition and resettlement, physical contingencies, consulting services for construction supervision and social and environmental safeguard management, and (ii) incremental cost of road maintenance. The construction cost estimates are derived based on the detailed design and bill of quantities. Costs related to taxes, duties, and financing charges during implementation have been excluded. Construction is assumed to take place over a two-year period starting from 2020. All estimated project costs and benefits are measured in 2019 economic prices expressed in US dollars using the official exchange rate. Using the domestic price numeraire, traded goods are measured at their border prices multiplied by a shadow

¹⁷ "Invest in Karakalpakstan – Investment Guide 2018", Chamber of Commerce and Industry of Uzbekistan, Authority for Foreign Investment of the Republic of Uzbekistan and UNDP, Tashkent, 2018

exchange rate factor (SERF) estimated at 1.04¹⁸, and non-traded inputs at domestic prices less indirect taxes to arrive at the total cost. A shadow wage rate factor (SWRF) of 0.619 was estimated and applied to unskilled labor used in road construction. A SWRF of 1.0 was applied to skilled and professional labor. The total financial cost excluding taxes is estimated at US\$ 264.7 million and economic costs derived is US\$ 260.2 million or US\$ 1.08 million per kilometer.

326. A straight-line depreciation method is used to calculate the residual value of project elements at the end of the analysis period. Among the project elements, the concrete pavement is assumed to have a life of 40 years with regular maintenance. Bridges and cross drainage structures can have a life of more than 40 years. Assuming a 40-year life for all structures, the residual value was calculated on a straight-line depreciation method and residual value estimated is 21 % at the end of the analysis period.
327. To calculate the incremental cost of maintenance costs, the without-project option maintenance regime was assumed to include routine maintenance and patching of damaged areas to the extent maintenance budgets are allocated (for the analysis 4% patching every year is considered) but no periodic maintenance was considered as the pavement structure require reconstruction. The with-project option maintenance regime involves routine maintenance, concrete slab and joint repairs. Maintenance unit costs adopted are based on the unit cost estimates made based on current prices.²⁰

H.3 Economic Benefits

328. The main quantifiable economic benefits are vehicle operating cost (VOC) savings, savings in travel time, benefits from improved road safety and environmental benefits from reduced vehicle emissions. The improvement in geometry, road signs and markings, improved layout of intersections are likely to reduce crashes. However, the improved road will likely increase the speed on the road and without directional segregation, may increase the probability for head-on collisions and severity of crashes. Considering the possibility of marginal positive and negative changes in road safety aspects, no benefit is considered in the analysis. The reduction in greenhouse gas emissions with improved level of service were estimated as part of the environmental impact assessment of the project and valued based on the global recommended value of \$36.3 per ton of CO2 equivalent in 2016 values²¹, increased by 2% in real terms annually.
329. **VOC savings.** To quantify VOC savings, technical and operational characteristics of the vehicle fleet were assessed. This included the price of vehicles, tires, and fuel, as well as maintenance and vehicle operation staff costs. These were adopted from existing data for Uzbekistan from 2014²². The prices were updated to 2019 prices considering inflation in the country for labor component such as maintenance labor and crew wages and the world average for vehicle and tire prices²³. Fuel price was adapted to reflect crude oil prices of \$80 per barrel expected in the medium term.
330. **Travel time cost savings.** Travel time savings have been calculated based upon the vehicle speed relationships included in the Highways Development Model-4 (HDM-4). These identify the number of minutes saved for each vehicle trip. These benefits have been monetised by applying values of time estimated for different categories of road users. The values of time were calculated using national average salary using the same approach used in the PADECO

¹⁸ Using the ADB simplified method based on merchandise imports of \$13,900 million, exports of \$13,300 million and estimated taxes on trade of \$973 million (import and export data from World Bank data and tax estimate based on weighted average tariff rates).

¹⁹ An approximation based on the ratio of wages for agricultural workers and construction workers obtained through local enquiry.

²⁰ Units costs (per sq.m) adopted are (i) for bituminous pavement maintenance \$4.5 for crack sealing, \$21 for patching, \$15 for overlay; and (ii) for concrete pavement maintenance \$9 for joint sealing, \$38 for full depth repair and \$48 for slab replacement. Annual routine maintenance costs are taken at \$1,000 per km for concrete pavements and \$2000 per km for bituminous pavements.

²¹ Intergovernmental Panel on Climate Change. *Fifth Assessment Report (AR5)*.

²² PADECO. 2014. "Strategic Network Level Assessment Volume 2 : HDM-4 Calibration" prepared for Republican Road Fund under Loan No. 2635-UZB CAREC Corridor 2 Road Investment Program Project 1, MFF/RAMS.

²³ IMF DataMapper, International Monetary Fund website"
<https://www.imf.org/external/datamapper/PCPIPCH@WEO/WEOWORLD>

study in 2014 where it is derived based on passenger income level. The average monthly salary in Uzbekistan is reported as 1,610,000 Soms and an annual salary increase of 20-25% is reported since the currency devaluation. Based on the average salary expected in 2019 and the exchange rate, the average salary in 2019 is estimated at US Dollar 218 and based on this income level value of time was estimated²⁴. Non-working time is valued at 30% of working time. The values adopted are given in Table 23.

Table 23: Adopted Values of Passenger Working and Non-Working Time (\$/Hour)

Vehicle Type	Value of Work Time	Value of Non-Work Time
Motorcycle	1.05	0.31
Car/4WD	2.05	0.61
Bus	1.05	0.31

Source: TRTA Consultant's estimates

331. For freight vehicles, the time value for cargo is the cost per vehicle-hour delayed of the cargo carried. The value is considered low for agriculture products, construction materials, chemical products, and other semi-manufactured products. The values from the PADECO study in 2014 was adopted by updating to 2019 prices considering inflation. The values of cargo delay cost per vehicle hour delay adopted range from \$0.24 for light trucks to \$0.79 for multi-axe vehicles.

H.4 Results of Economic Analysis

332. An economic analysis of the project was carried out following the Asian Development Bank's (ADB) guidelines²⁵ and by comparing transport costs for road agency and transport users "with" and "without" project options. The proposed project will be implemented as six contract packages over a 3-year construction period. The analysis compared the incremental benefits of reductions in VOCs, travel times and vehicle emissions resulting from the project with the initial investment costs and changes in operation and maintenance costs over a 33-year appraisal period (three years implementation and 30 years operation). The results of the economic analysis are summarized in Table 24, expressed in terms of the key economic indicators, namely benefit to cost ratio (BCR), economic internal rate of return (EIRR) and net present value (NPV) at a 9% discount rate. The results indicate that the project has a rate of return well above the opportunity cost of 9%. The cost-benefit streams are given in Table 26.

Table 24: Results of Economic Analysis

Project Road	EIRR (%)	NPV (USD Million)
A380 (Km 964 to 1204)	13.8	171.9

EIRR = economic internal rate of return; NPV = net present value.

333. Further, sensitivity analysis was carried out for the road sections over the base case with respect to adverse changes in the costs and benefits. The following cases were analyzed: (i) base case; (ii) a 15% increase in cost; (iii) a 15% decrease in total benefits; (iv) Two-year construction delay, (v) a 15% increase in cost and a 15% decrease in benefits, (vi) no emissions benefit. The results of sensitivity analysis are presented in Table 25 below. The analysis shows that the project has an EIRR more than 9% in all sensitivity cases.

²⁴ Hourly average salary rate estimated at US\$ 1.36 and car passenger value of time is assumed at 1.5 times the average value and bus passenger time is assumed at average salary rate. About one-third of bus passengers are assumed to be unskilled workers with a value of time at half the average salary rate and multiplied by shadow wage rate factor.

²⁵ ADB. 2017. *Guidelines for the Economic Analysis of Projects*. Manila.

Table 25: Sensitivity Analysis Results

Case	EIRR	NPV, \$m	Switching value
Base case	13.8	171.9	
Cost +15%	12.6	142.3	+88%
Benefits -15%	12.5	119.1	-49%
Two year construction delay	12.3	128.1	NA
No emission reduction benefits	13.3	154.4	NA
Cost+15% & benefits -15%	11.8	100.5	+36% & -36%

() = negative, EIRR = economic internal rate of return, NPV = net present value.

Table 26: Costs and benefits streams
(2019 domestic prices, \$m, undiscounted)

Year	Incremental Costs		Incremental Benefits			Total Net Benefits
	Capital Works	Recurrent Works	Reduced Vehicle Operating Cost	Reduced Travel time	Emission Reduction	
2019						
2020	51.8	-0.4	0.0	0.0	0.0	-51.4
2021	103.7	-0.8	0.0	0.0	0.0	-102.8
2022	103.7	-1.0	0.0	0.0	0.0	-102.6
2023	0.0	-1.7	14.6	1.4	2.0	19.7
2024	0.0	-1.7	15.4	1.7	2.0	20.9
2025	0.0	-1.7	16.7	2.1	2.1	22.5
2026	0.0	-1.7	18.3	2.5	2.1	24.6
2027	0.0	-1.7	19.9	2.9	2.2	26.7
2028	0.0	-1.7	21.7	3.4	2.2	29.1
2029	0.0	-1.7	23.7	4.0	2.3	31.6
2030	0.0	-1.7	25.9	4.6	2.3	34.5
2031	0.0	-1.7	28.3	5.2	2.3	37.6
2032	0.0	-1.7	30.9	6.0	2.4	41.0
2033	0.0	-1.7	33.8	6.8	2.4	44.7
2034	0.0	-1.7	36.9	7.7	2.5	48.8
2035	0.0	-1.7	40.3	8.7	2.5	53.3
2036	0.0	-1.7	44.1	9.7	2.6	58.1
2037	0.0	-1.7	48.1	10.9	2.6	63.4
2038	0.0	-1.7	52.6	12.2	2.7	69.3
2039	0.0	-1.7	57.5	13.7	2.8	75.6
2040	0.0	-1.7	62.8	15.2	2.8	82.5
2041	0.0	-1.7	68.5	16.9	2.9	90.0
2042	0.0	-1.7	74.8	18.8	2.9	98.2
2043	0.0	-1.7	81.6	20.8	3.0	107.1
2044	0.0	-1.7	88.8	23.0	3.0	116.6
2045	0.0	-1.7	96.7	25.5	3.1	126.9
2046	0.0	-1.7	105.2	28.1	3.2	138.2
2047	0.0	-1.7	114.6	31.0	3.2	150.5
2048	0.0	-1.7	122.7	33.6	3.3	161.3
2049	0.0	-1.7	128.4	35.4	3.4	168.7
2050	0.0	-1.7	132.6	36.7	3.4	174.4
2051	0.0	-1.7	136.9	38.1	3.5	180.2
2052	-54.4	-1.7	141.4	39.6	3.6	240.7
					EIRR	13.8%
					NPV@ 9%	171.9

EIRR = economic internal rate of return, NPV = net present value.

Source: PPTA Consultant assessment.

H.5 Financial Analysis

334. The financial analysis has been conducted in accordance with ADB guidelines: Financial Management and Analysis of Projects (2005) and Financial Due Diligence: A Methodology Note (2005). The project is a non-revenue generating project and therefore the objective of the analysis is to ensure that the project is financially sustainable. The financial analysis also focused on assessing the capacity of the implementing agency to absorb the incremental operation and maintenance (O&M) cost associated with project. With concrete pavement, the project is expected to reduce the periodic and routine maintenance requirements considerably. In the with-project option, routine maintenance requirements are below the budget allocations by the government and no major/periodic maintenance requirement is anticipated during the analysis period. The average expenditure on maintenance of the public roads in the plan period 2007–2012 was about \$2,823 per km, whereas in the 2015–2019 plan period it is estimated to be about \$7,680 per km, indicating significant increase in allocation. The expenditure/budget allocation for the period 2016–2020 is given in Table 27. The financial investment for roads will more than double between 2016 and 2020 with more increase in the maintenance expenditure than construction indicating more focus on maintenance. There have been changes in the currency values with deregulation during this time period and part of the large increase may be due to the effect of currency deregulation also. However, the projected maintenance estimate for 2019 and 2020 considering the current exchange rate works out to an average of \$8,160²⁶ per km which is in accordance with the budget allocation in the plan period. The estimated annual maintenance requirement for the project road is well within this allocation and therefore it can be concluded that sufficient maintenance funding will be allocated over the life of the project.

Table 27: Expenditure on executed works in 2016–2018 and forecast for 2019–2020 for automobile roads (in Billion UZS)

Expenditure (Actual/Projected)	2016	2017	2018	2019	2020
Construction Expenditure	1097.9	698.5	808.1	1827.4	2097.6
Maintenance Expenditure	1196.6	1523.5	2816.2	2664.0	3052.6
Equipment and Technology	51.8	125.6	567.4	250.0	400.0
Total	2346.2	2347.5	4191.7	4741.4	5550.2

Source: Project Implementation Unit, Republican Road Fund, Committee for Roads, Uzbekistan

335. A well-constructed concrete pavement will have no periodic maintenance needs over the 30 year analysis period as in case of bituminous pavements and will only require maintenance of any localized damages apart from routine maintenance. The maintenance budget allocation is considered to be sufficient to meet the maintenance needs during the analysis period.

²⁶ Maintenance budget allocation is estimated at US\$ 313.4 million in 2019 and US\$ 359.1 million in 2020 at an exchange rate of 1US\$=8,500 UZS and this works out to US\$ 7,460 and US\$ 8550 per km in 2019 and 2020 respectively towards road maintenance.

I. Financial Management and Plan

I.1 Financial Management Assessment

336. The Financial Management Assessment (FMA) was conducted by an International Financial Management Specialist of Sheladia Associates Inc. USA during February 2019 in accordance with ADB's Guidelines for the Financial Management and Analysis of Projects²⁷ and Financial Due Diligence: a Methodology Note²⁸, and Technical Guidance Notes²⁹. The assessment was an updating on the FMA for the Kashkadarya Regional Road Project, carried out during June 2016. The FMA considered the capacity of the PMU, including funds-flow arrangements, governance, staffing, budgeting, accounting and financial reporting systems, internal control procedures, financial information systems, and internal and external auditing arrangements.
337. The assessment has been carried out as a part of the due diligence of the proposed Karakalpakstan Road Project (Project) for ADB financing. Most of the staff of existing PMU implementing the Kashkadarya Regional Road Project is expected to join the Project PMU. The fiduciary assessment of the existing PMU is carried out to determine the degree to which the financial management arrangements are adequate to manage fiduciary risks and provide reasonable assurance that ADB funds will be used for their intended purpose, once existing PMU staff join Project PMU. The FM assessment found that: i) PMU has the required policies and procedures in place, and that (ii) the compliance with the Loan agreement L3355-UZB for timely audited project financial statement (APFS) submission has been complied with 2 months delay for FY2018 while being deferred for the FY2016 and FY2017. The assessment also identified the following risk areas: (i) lack of financial management capacity at PMU which may lead to delays in APFS submission deadlines compliance, (ii) missing financial management procedures manual, and (iii) absence of Internal Audit function. As a result, the overall financial management risk is assessed as moderate.
338. The identified risks will be mitigated in the Project PMU by: (i) hiring of additional FM specialist, (ii) providing PMU staff training on ADB disbursement and financial management procedures and requirements, (iii) adoption of financial management procedures manual, (iv) ensuring quarterly internal audits, (v) quarterly financial reporting, as well as (vi) appointment of APFS auditor for the period of 5 years. Moreover, PMU will maintain separate books of accounts for the project and the project financial statements will be audited annually by an auditor acceptable to ADB, following auditing standards acceptable to ADB.

²⁷ ADB. 2005. *Financial Management and Analysis of Projects*. Manila. Available: <http://www.adb.org/Documents/Guidelines/Financial/default.asp>

²⁸ ADB. 2009. *Financial Due Diligence: A Methodology Note*. Manila. Available: <http://www.adb.org/documents/financial-due-diligence-methodology-note>

²⁹ ADB: 2015. *Financial Management Technical Guidance Note*
<https://www.adb.org/sites/default/files/page/82468/financial-management-assessment.pdf>

J. Procurement

J.1 Procurement Plan

J.1.1 Basic Data

339. The procurement plan was prepared and coordinated with the PMU and ADB according to decision on the packages and procurement method during pre-fact finding mission in September 2019. Basic Data is shown in the table below.

Table 28: Basic Data

Project Name: CAREC Corridor 2 Karakalpakstan Road Project	
Project Number: 48414-006	Approval Number:
Country: Uzbekistan	Executing Agency: Committee for Roads under the Ministry of Transport
Project Procurement Classification: Category A	Implementing Agency: Project Management Unit under the Committee for Roads
Project Procurement Risk: High	
Project Financing Amount: US\$ 383.4 million ADB Financing: US\$ 274.2 million Co-financing (ADB Administered): Non-ADB Financing: US\$ 109.2 million	Project Closing Date: 30 June 2026
Date of First Procurement Plan: 27 August 2019	Date of this Procurement Plan: 22 September 2019
Procurement Plan Duration: 24 months	Advance Procurement: Yes E-procurement: No

J.1.2 Methods, Review and Procurement Plan

340. Except as ADB may otherwise agree, the following methods shall apply to the procurement of goods, works, non-consulting services, and consulting services.

Table 29: Methods for procurement of goods, works and non-consulting services

Procurement of Goods, Works and Non-Consulting Services	
Method	Comments
Open competitive bidding with national advertising for goods (Not envisioned)	Road materials and equipment are available locally and the local market is competitive
Open competitive bidding with international advertising for works	Local contractors are inexperienced in best-in-class highway development and international advertising is warranted

Table 30: Method for procurement of consulting services

Consulting Services	
Method	Comments
Open competitive bidding with international advertising, using quality- and cost-based selection for consulting services	One construction supervision consultant is required, and international advertising is warranted
Least Cost Selection for Consulting Firm	Financial Audit companies are available in the local market
Open competitive bidding for Individual Consultants	For selection of national and international individual consultants to support PMU

J.1.3 List of active Procurement Packages (Contracts)

Table 31: Goods, works and non-consulting services

Goods, Works and Non-Consulting Services							
Package Number	General Description	Estimated Value (in US\$)	Procurement Method	Review	Bidding Procedure	Advertisement Date	Comments
	Reconstruction of 240 km road section from km 964 to km 1,204 on A380 (Kungrad to Daut-Ata section). 6 lots:	222.7 million	OCB	Prior	1S1E	November 2019	Advertising: International No. of Contracts: 2 contract packages, 3 lots each.
KRP/OCB/CW/01	KRP/OCB/CW/01-Lot 1 964km-1004km	38.6 million					Prequalification of Bidders: No
	KRP/OCB/CW/01-Lot 2 1004km-1044km	35.6 million					Domestic Preference Applicable: No
	KRP/OCB/CW/01-Lot 3 1044km-1084km	35.8 million					Advance Contracting: Yes
KRP/OCB/CW/02	KRP/OCB/CW/02-Lot 1 1084km-1124km	35.3 million					Bidding Document: ADB Large Works. June 2018.
	KRP/OCB/CW/02-Lot 2 1124km-1164km	37.4 million					Estimated value is exclusive of VAT
	KRP/OCB/CW/02-Lot 3 1164km-1204km	40 million					E-Procurement: No
KRP/OCB/CW/03	Community Development (5 rest stops with market stalls; 2 multipurpose community complexes in Jaslik and Karapalkstan)	1,050,000	OCB	Prior	1S1E	TBD	Advertising: International No. of Contracts: 1. Prequalification of Bidders: No

Goods, Works and Non-Consulting Services							
Package Number	General Description	Estimated Value (in US\$)	Procurement Method	Review	Bidding Procedure	Advertisement Date	Comments
							Domestic Preference Applicable: No Advance Contracting: Yes Bidding Document: ADB Small Works. June 2018. Estimated value is inclusive of VAT E-Procurement: No
KRP/OCB/SI/01	Supply and installation of weigh-in-motion systems (WIM)	2.8 million	OCB	Prior	1S1E	June 2020	Advertising: International No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference Applicable: No Advance Contracting: Yes Bidding Document: ADB Small Works. June 2018. Estimated value is inclusive of VAT E-Procurement: No
KRP/OCB/SI/02	Supply and Installation of intelligent transport systems (ITS)	15.3 million	OCB	Prior	1S1E	December 2020	Advertising: International No. Of Contracts: 1 Prequalification of Bidders: No Domestic Preference

Goods, Works and Non-Consulting Services							
Package Number	General Description	Estimated Value (in US\$)	Procurement Method	Review	Bidding Procedure	Advertisement Date	Comments
							Applicable: No Advance Contracting: No Bidding Document: ADB SBD Procurement of IT Products and Services June 2018. Estimated value is inclusive of VAT E-Procurement: No

1S1E = single-stage-one-envelope, km = kilometer, OCB = open competitive bidding, Q = quarter.

Table 32: Consulting services

Consulting Services							
Package Number	General Description	Estimated Value (in US\$)	Selection Method	Review	Type of Proposal	Advertisement Date	Comments
KRP/OCB /QCBS-01	Construction Supervision of Road Works	5.0 million	QCBS	Prior	FTP	November 2019	Type: Firm Assignment: International Quality-Cost Ratio: 80:20%% Advance Contracting: Yes Contract estimated value is inclusive of VAT
KRP/OCB /QCBS-02	Construction Supervision of WIM and ITS	2.2 million	QCBS	Prior	FTP	December 2019	Type: Firm Assignment: International Quality-Cost Ratio: 80:20%% Advance Contracting: Yes Contract estimated value is inclusive of VAT
KRP/OCB /LCS-01	Audit of Project Financial Statements	0.10 million	LCS	Prior	BTP	Jan 2020	Type: Firm Assignment: International
KRP/IC/01	Financial Auditor	0.12 million	IC	Prior	TOR	Jan 2020	Type: Individual Assignment: National

Consulting Services							
Package Number	General Description	Estimated Value (in US\$)	Selection Method	Review	Type of Proposal	Advertisement Date	Comments
KRP/OCB /IND-01	International Contract Specialist	0.21 million	ICS	Prior	TOR	Q4/2019	Type: Individual Assignment: International
KRP/OCB /IND-02	International Procurement Specialist	0.21 million	ICS	Prior	TOR	Q4/2019	Type: Individual Assignment: International
KRP/OCB /IND-03	International Biodiversity Specialist	0.21 million	ICS	Prior	TOR	Q4/2019	Type: Individual Assignment: International
KRP/OCB /IND-04	National Environment Specialist	0.05 million	ICS	Prior	TOR	Q1/2020	Type: Individual Assignment: National
KRP/OCB /IND-05	National Resettlement Specialist	0.05 million	ICS	Prior	TOR	Q1/2020	Type: Individual Assignment: National
KRP/OCB /IND-06	National Gender Specialist	0.05 million	ICS	Prior	TOR	Q1/2020	Type: Individual Assignment: National

Q = quarter, QCBS = quality- and cost-based selection, FTP = full technical proposal

J.1.4 List of indicative Packages (Contracts) required under the Project

341. The following tables list goods, works, non-consulting, and consulting services contracts for which procurement activity is expected to commence beyond the procurement plan duration and over the life of the project (i.e., those expected beyond the current procurement plan's duration).

Table 33: Goods, works and non-consulting services beyond procurement plan duration

Goods, Works and Non-Consulting Services							
Package Number	General Description	Estimated Value (in US\$)	Procurement Method	Review	Bidding Procedure	Advertisement Date	Comments

Table 34: Consulting services beyond procurement plan duration

Consulting Services							
Package Number	General Description	Estimated Value (in US\$)	Selection Method	Review	Type of Proposal	Advertisement Date	Comments

J.1.5 List of awarded and completed Contracts

342. The following tables list the awarded and completed contracts for goods, works, non-consulting, and consulting services.

Table 35: Awarded and completed goods, works and non-consulting services contracts

Goods, Works and Non-Consulting Services					
Package Number	General Description	Contract Value (in US\$)	Date of ADB Approval of Contract Award	Date of Completion	Comments
None					

Table 36: Awarded and completed consulting services contracts

Consulting Services					
Package Number	General Description	Contract Value (in US\$)	Date of ADB Approval of Contract Award	Date of Completion	Comments
None					

J.1.6 Non-ADB financed Contracts

343. The following table lists goods, works, non-consulting, and consulting services contracts over the life of the project, financed by non-ADB sources.

Table 37: Non ADB-financed goods, works and non-consulting services

Goods, Works and Non-Consulting Services				
General Description	Estimated Value (cumulative)	Estimated Number of Contracts	Procurement Method	Comments
None				

Table 38: Non ADB-financed consulting services

Consulting Services				
General Description	Estimated Value (cumulative)	Estimated Number of Contracts	Procurement Method	Comments
None				

J.2 Procurement Risk Assessment and Strategic Procurement Planning

344. The procurement risk assessment and strategic procurement planning were drafted in line with the current ADB guidelines and are attached to this report as Appendix 8.

J.3 TOR for Site Supervision Consultants

345. A first draft of the TOR for the site supervision consultant was prepared and is attached as Appendix 9.

K. Bidding Documents

346. SHELADIA team prepared the draft bidding documents to the extent possible, based on the available information, i.e. the split of the 240 km long project road section into 6 lots and the duration of construction being 18 months. They were shared with ADB and PMU on June 14, 2019. Draft TOR for the site supervision and a tentative budget were elaborated by SHELADIA team in February 2019 and submitted to PMU. No comments were received and the TOR was shared with ADB on July 4, 2019. However, the tentative budget prepared by the Consultant was reviewed by the EA and following adjusted as deemed appropriate. This estimate was further used to determine the project costs.
347. ADB commented on the draft bidding documents on June 28, 2019. The comments were addressed and a comment compliance matrix was prepared. Together with the updated bidding documents this matrix was submitted to the client on July 2, 2019. After the final decision to consider a construction period of 24 month was made by CR, the Consultant again adjusted the bidding documents to reflect the necessary amendments. The documents were submitted to ADB on July 21.
348. During the September 2019 pre-fact finding mission of ADB, CR took the final decision to advertise the civil works for the reconstruction of the 240 km in 2 packages, each with 3 lots à 40 km length. Works shall be procured using the single-stage-one-envelop (1S1E) method. The bidding documents were revised accordingly and re-submitted to ADB.

L. Design and Monitoring Framework

L.1 Project Objectives

349. The preliminary Design and Monitoring Framework (DMF) given in the project concept paper for the initially proposed MFF has identified the main objective or impact of the project as "Increased international trade and tourism along the CAREC Corridor in Uzbekistan". The proposed Karakalpakstan Road Project is anticipated to contribute to enhanced trade on the CAREC Corridor 2 between Uzbekistan, Kazakhstan and Russia.
350. Being one of the major highways in the Republic of Karakalpakstan, the project will improve the overall road connectivity/accessibility in the Republic of Karakalpakstan and the Republic of Uzbekistan with the neighboring countries. It will also help to maintain the created road asset in a sustainable manner. The Project DMF shall include indicators and targets to measure how the proposed project implementation will meet the envisaged project objectives and outcomes.
351. The project also includes an institutional capacity development component of the Committee for Roads (CR) under the Ministry of Transport (MOT), that aims to advance effective axle load control and road traffic management.

L.2 Design and Monitoring Framework for the Project

352. The possible project impacts and set of indicators that can be measured over the project implementation and operation period were examined. The main consideration in choosing the indicators was the ease with which indicator can be quantitatively assessed and can be compared with set targets to monitor the project performance. The implementing agency should be able to gather the required data on a periodical basis with limited resources and the analysis and interpretation should only need limited effort. The DMF and baseline data are listed in Table 39. There is one major outcome anticipated from the implementation of the proposed ADB project. This is:
 - Improved travel time and efficiency on the reconstructed section of the A380 highway
353. The road under consideration is an existing road that is in fair to poor condition and needs to be rehabilitated. It is the main link of the Republic of Karakalpakstan and the Republic of Uzbekistan to Kazakhstan and provides a trade access to the Caspian Sea. The proposed road improvement will facilitate the increased economic activity with improved mobility. The project influence area is taken as the Kungrad region in which the project road is located. In the case of enhanced road transport efficiency, the impacts will include increased traffic growth, reduced travel time, reduction in road accidents, improved riding quality, all of which can be measured/monitored for project road. The other components are expected to supply and install weigh bridges as well as the development of an intelligent transport system for the country.

Regional trade on the CAREC Corridor 2 between Uzbekistan and Kazakhstan enhanced.

Results Chain	Performance Indicators with Targets and Baselines	Data Sources and Reporting Mechanisms	Risks
Outcome Travel time and efficiency on the reconstructed section of the A380 highway improved	a. Increased use of road measured by rise in average daily vehicle-km on A380 (240 km section) from 370,000 (2018) to 470,000 (2023) b. Travel time between Kungrad and Daut-Ata reduced by 15% by 2023 (2019 baseline: 4.4 hours).	a. CR periodic survey reports b. ADB's project completion report and project performance evaluation report	<ul style="list-style-type: none"> External and internal economic factors slowing the investment in agricultural and industrial sectors and reduced import and export Inadequate financial resources for road maintenance
Outputs 1. Road from Kungrad to Daut-Ata reconstructed	1a. By 2023, 240 km section of A380 road reconstructed 1b. By 2023, pavement roughness measured in terms of International Roughness Index of less than 3 achieved on the reconstructed road 1c. Five (5) rest stops in Jaslik and Karakalpakstan constructed with market stalls, 50% of which will be for women and separate sanitary facilities for women and men, diaper changing tables, access ramps for baby strollers and wheelchairs, (2019 baseline: 0) 1d. Two (2) multipurpose community complexes constructed in Jaslik and Karakalpakstan with facilities for livelihood training programs, maternal and child health care services (baseline: 0)	1a. Consultant's reports 1b. CR reports	<ul style="list-style-type: none"> Implementation delays caused by contract registration procedures Contract management issues and disputes could affect project implementation Cost overruns are caused by unexpected price increases beyond contingency during construction
2. Intelligent transport system developed	2a. Intelligent Transport System developed for the country by 2024 (2019 baseline: none)	2a. Consultant's and CR reports 2b. Consultant's and CR reports	

Results Chain	Performance Indicators with Targets and Baselines	Data Sources and Reporting Mechanisms	Risks
3. Supply and installation of weigh-in-motion system	<p>2b. Intelligent Transport System pilot tested by 2027 (2019 baseline: none)</p> <p>2c. 50 CCTVs installed to monitor and address critical incidents involving women, children, elderly, and persons with disabilities (2019 baseline: 0)</p> <p>2d. sex-disaggregated data on road crashes by type of road user and incident reported yearly by the Committee for Roads (baseline: 0)</p> <p>3a. 3 weigh-in-motion systems supplied, installed and commissioned by 2024 (2019 baseline: none)</p>	3a. Consultant's and CR reports	

M. Lessons Learnt

M.1 The Consultant

354. The Consultant mobilized in November 2018. After mobilization, it turned out, that the project documents were not fully available for review. They were subsequently submitted, with a final submission of the DD documentation in April 2019. It should be assured, that the DD preparation is completed before TA mobilization, as delays have significant impact to Consultant's staffing schedule and resources.

M.2 ADB

355. Based on current experience in a number of projects, it is highly recommended, that ADB assures, that the project documentation is actually completed by the designer before the Consultant mobilizes. The Consultant suggests, that ADB requests a copy of the signed contract between the designer and the client prior to the start of TA's. This will allow an assessment of the design progress since contract signature.

M.3 Committee for Roads / PMU

356. For projects under funding of international financing institutions and the involvement of international consultants, it is essential to have preparation of FS and DD documentations by local design companies with English capacity. Otherwise, international consultants will face difficulties to efficiently carry out their activities especially during the design review.
357. CR should request the submission of the full FS and DD documentation from the national designer companies including a soft copy as part of the contract. This will support an efficient submission of data to all involved parties.
358. The establishment of a new PMU for each project does not contribute to capacity building and knowledge transfer. CR should reconsider the organization structure of PMU's.

M.4 Road Design Institute

359. RDI has a lot of experience in the preparation of FS and DD documentations according to national standards. However, the compilation of the DD documentation lacks a consistent structure of some parts of the project, e.g. the railway level crossing and utility relocation design. RDI shall give clear instructions to the sub-consultants related to the structure of the design documentation, the language and software to be used etc.
360. It is of utmost importance to establish a quality management system at RDI. There is no common regulation how records of revisions are kept, how documents have to be named, how drawings are to be produced, which formats shall be used and so on. Quantities of works should be solely given in the BoQ and not on the drawings.
361. Further assistance to build capacity of RDI could be in the form of seminars, workshops, on-the-job training, etc. Another step might be a jointly with an international consulting company prepared FS and DD of one selected project in the near future.