THE REPUBLIC OF TAJIKISTAN
MINISTRY OF TRANSPORT

PREPARATORY SURVEY REPORT
ON
THE PROJECT FOR
THE REHABILITATION
OF
KIZILKALA–BOKHTAR SECTION
OF
DUSHANBE–BOKHTAR ROAD

FINAL REPORT

February 2019

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

CTI ENGINEERING INTERNATIONAL CO., LTD.

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PREFACE

Japan International Cooperation Agency (JICA) decided to conduct the “Preparatory Survey for the Project for the Rehabilitation of Kizilkala-Bokhtar Section of Dushanbe–Bokhtar Road” and entrusted the survey to the CTI Engineering International Co., LTD.

The survey team held a series of discussions with the officials concerned of the Government of Tajikistan, and conducted a field investigations.

As a result of further studies in Japan, the present report was finalized. I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Republic of Tajikistan for their close cooperation extended to the survey team.

February, 2019

Itsu ADACHI
Director General
Infrastructure and Peacebuilding Department
Japan International Cooperation Agency

SUMMARY

1. Situation of the Republic of Tajikistan

Road network plays a vital role in the socio-economic growth of Tajikistan, as 92% of domestic freight and 98% of passenger transport rely on roads. It is an economic axis for domestic and international logistics. In particular, Dushanbe - Bokhtar Road (DB Road) is an arterial road which is positioned as one of the most important route in Tajikistan. In addition, the DB Road is a part of the Asian Highway No.7 (AH7) as well as a part of Central Asia Regional Economic Cooperation (CAREC) 6 which is the international corridor that has been initiated by Asian Development Bank (ADB) to develop the high standard road network in Asia.

Since independence from the Soviet Union in 1991, the country experienced a fateful civil war in the early 90s causing a severe economic setback which forced road assets unattended and many roads damaged.

The long-term strategy (NDS: National Development Strategy to 2030) formulated by the government of Tajikistan (GOT), emphasizes development of roads, in particular the international roads, and improvement of the regulation in transport sector as two major pillars for achieving sustainable and equitable economic growth of the country.

This Project, which is aimed at Rehabilitation of Kizilkara – Bokhtar section of DB Road (L=82.0km), is to improve the existing road by widening from two lanes to four lanes. As annual increasing rate of traffic volume of the DB Road is approximately over 7%, this project is essential to stimulate the economy of Tajikistan and expected to contribute to realization of the goals of NDS.

2. Requested Scope

The request made by GOT is to rehabilitate 9.2 km of the Kizilkala – Bokhtar section of Dushanbe – Bokhtar road, by widening of two lanes to four lanes and improving existing road facilities.

3. Preparatory Survey Schedule

In order to implement the Project properly and effectively under Japanese grant aid assistance, the Preparatory Survey was conducted as follows;

- April to June 2018: Consultation and discussion on IC/R and conducting first site survey

- June to November 2018: Outline design and cost estimation in Japan
- August 2018: Outline design consultation and discussion, conducting SHM (Stakeholders' meeting), obtaining approval on the project scope, and conducting supplementary survey
- November 2018: final survey (Consultation and discussion on the draft final report)

4. Contents of the Project

As a result of the field survey, contents of the project finally are as shown in Table-1.

Table-1 Contents of the Project

Type	Item		Quantity	Remarks
Road	Objective Length		9.2 km	● Start Point : End point of ADB Phase2 section (STA.730+50) ● End point : STA.822+10.799
	Number of Lanes		4-lane	● Carriageway width 3.5m
	Shoulder	Standard Section (Start point-STA.807+20)	2.5 m	● Widened shoulder was applied with considerations for gender equality, school children use and low-speed vehicles
		Bokhtar Section (STA.807+20-End point)	1.75 m	
	Median	Standard Section (Start point-STA.807+20)	3.0 m	● These widths include marginal strip (inner shoulder) of 0.5m.
		Bokhtar Section (STA.807+20-End point)	2.0 m	
	Sidewalk		2.25 m	● On both sides
	U-turn Lane		2 locations	● STA.737+20: One-direction (Bokhtar to Bokhtar) ● STA.802+60: Both-directions
Structure	Cross Drainage (Precast box culvert)		16 locations	● 8 locations for irrigation ● 8 locations for drainage
	Box Culvert		2 locations	● Replacement of existing bridges (No.15 & No.16)
	Road Surface Drainage	L-type Gutter	13 km	● For road surface drainage
		U-type Gutter	14 km	● For road surface drainage and toe of slope
Road Ancillary	Zebra Crossing (Unsignalized)		7 locations	● Where access roads are connected to the project road.
	Road Marking for Speed Reduction		7 locations	● Installed ahead and forth of zebra crossing in the longitudinal direction
	Regulatory Sign		All sections	● According to SNiP and GOST
	Reflective road Studs		5 km	● Installed at every 10m interval in sections where street lights are not provided

Type	Item	Quantity	Remarks
	Shoulder rumble strips	18 km	● Installed outside of shoulder line
	Pedestrian Guardrail	14 km	● In the section where embankment height is 3m or more
	Gravity Walls	82.4 m	● For adjusting difference in height to the existing ground level
	Bus Bays	8 locations	● Installed at/nearby the existing bus bays
	Revetment	2 rivers	● Upstream and downstream of No15 and No.16 box culverts
	Signalized Intersections	2 locations	● STA.774+60 and after STA.820
	Street Lights	4 km	● In the section of zebra crossing and signalized intersection

5. Project Implement Schedule and Project Cost

The implementation period of the Project is estimated to be 9 months for detailed engineering design (including bidding of construction works), and 22 months for construction work.

The project cost to be borne by the recipient country is estimated to be about 1.3 million US Dollar.

The cost to be borne by the Japan's Grant Aid is not shown in this report due to the confidentiality.

6. Project Evaluation

(1) Relevance

- An approximate 340,000 residents of the project area are direct beneficiaries of the Project. On the other hand, an approximate 2.7 million people is assumed users of project road.
- This Project will contribute to easing traffic congestion and smoothing transportation of people and freight as well. It is highly expected that this will eventually lead to a comprehensive transportation network development for logistics throughout the nation.
- This Project will be immediately and strongly needed to secure stability of people's lives, development of their daily lives, and securing BHN (Basic Human Needs).
- Excessively advanced technique is not necessary for this Project. Tajikistan side

can manage to run, operate and maintain the improved road, related structures, and facilities by using own fund, own local manpower and locally available technical skills.

- This project will be equally consistent with the policy and target described in the NDS (National Development Strategy to 2030). This Project can help in achieving enhancement of AH network improvement.
- There is little negative impact upon environmental and social condition.
- Performing the Project will justify the incentive as well as necessity to utilize Japanese most advanced and cutting-edge construction technology, such as time control, safety control, and quality control. Through the Japan's Grant Aid Scheme, the Project will be conducted adequately without any serious issues.

(2) Effectiveness

1) Quantitative Effect

The expected quantitative effect to be produced through performing the works of target Project for economic cooperation is shown in the following Table-2. The values of base year (2018) before conducting the Project and target year (2024) in three (3) years over completion of the Project are respectively set up.

Table-2 Quantitative Effects

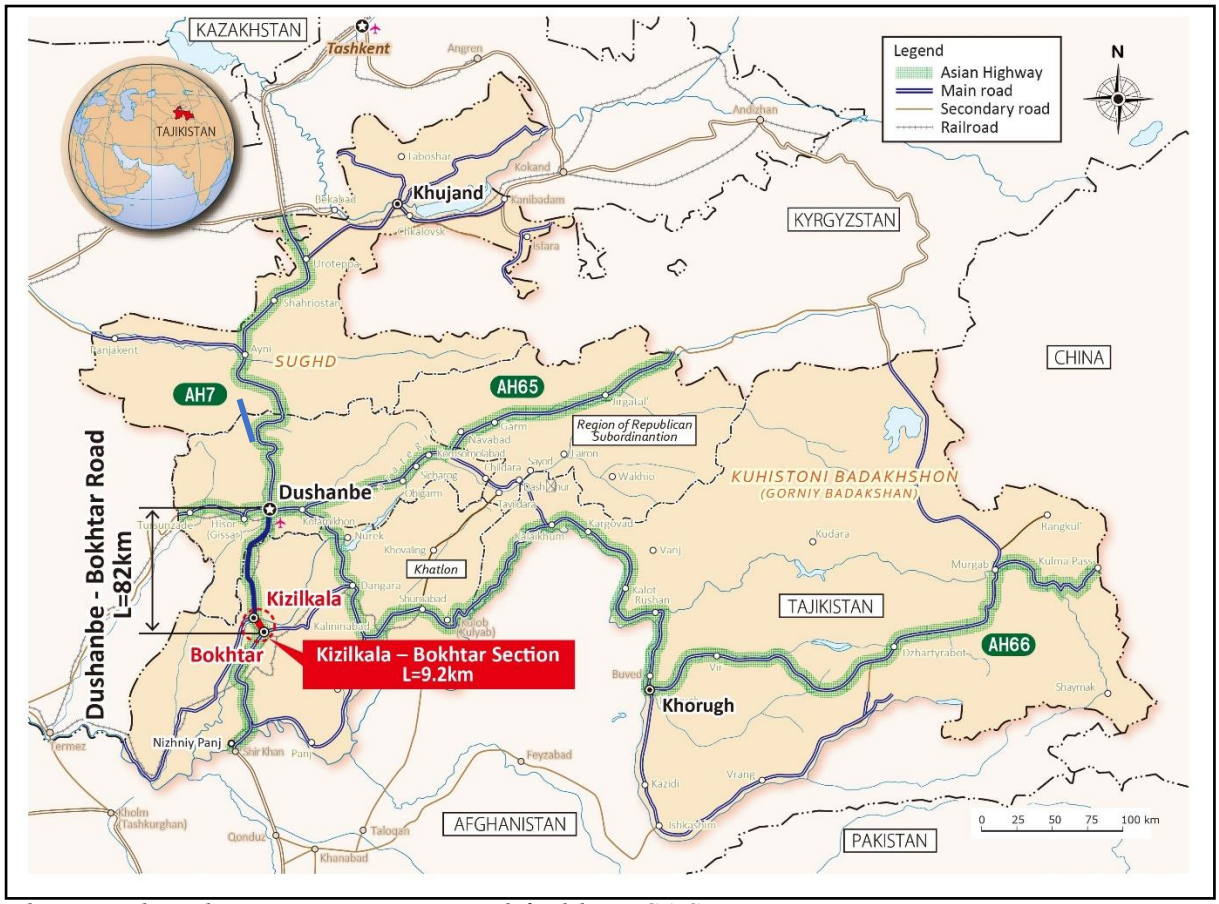
Index	Current Value (as of 2018)	Design Value (as of 2024)
Traffic Volume	15,560 vehicle/day	21,100 vehicle/day
Volume of Passengers	69,966 person /day	84,700 person /day
Volume of Cargo	7,503 ton / day	9,700 ton / day
Travelling Time* *Dushanbe – Bokhtar Road starting from the beginning of improved section to the end point of the project, including ADB section	102.2 minutes	84 minutes

2) Qualitative Effect

The prospective effects are;

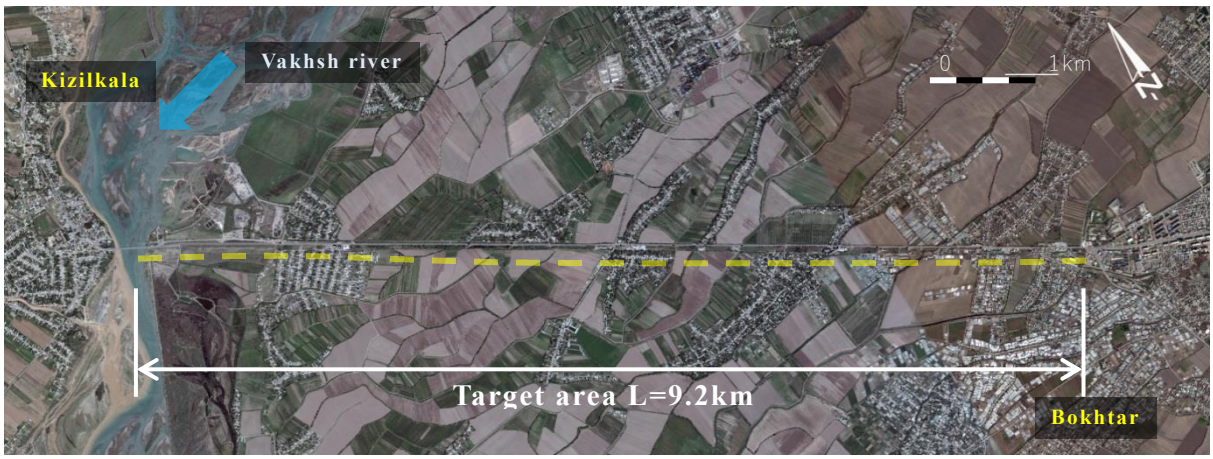
(1) To promote logistics efficiency and improve punctuality between Dushanbe and Afghanistan
(2) To contribute vitalization of economic activity by reducing transporting cost
(3) To secure traffic safety for pedestrian due to installation of sidewalk
(4) To improve traffic safety in driving during night time

PROJECT LOCATION MAP



This map, based on a UN map, was modified by JICA Survey Team

The depiction and use of boundaries, geographic names and related data shown on map do not necessarily imply official endorsement or acceptance by JICA.



PERSPECTIVE

Standard Section

Intersection at the Entrance of Bokhtar City

PHOTOS

Explanation on Inception Report	Discussion with ADB
	
Meeting to Explain to Local Residents	**1st Joint Technical Meeting**
	
Explanation on Draft Final Report	**2nd Joint Technical Meeting**
	
Meeting on Minutes of Discussion	**Signing on Minutes of Discussion**
	

ADB Section	Overview from the Start Point
ADB Section Phase I (Oct. 2017 to Oct. 2020, L=33.200km) Phase II (Oct. 201to Oct. 2021, L=:39.575km)  Construction in Phase-I section has already commenced.	 Project road alignment forms a straight line.
Traffic Situation (1)	Traffic Situation (2)
 Durable pavement structure against heavy vehicls is necessary.	 Slow moving objects such as livestock and farming tractors can be seen.
Traffic Situation (3)	Pavement Condition
 Slow moving objects such as bycicle and pedestrian can be seen.	 Site observations confirmed numerous localized alligator cracks.
Road Side Situation (1)	Road Side Situation (2)
 There are the utilities such as electric line and underground commnunication cable.	 Hotels are located along the road around the end point.

Situation of Drainage Facility (1)	Situation of Drainage Facility (2)
 The existing drainage cross pipes are aged and weak and the volume of the water is high.	 The existing drainage cross pipes are aged and weak and the volume of the water is high.
Situation of Existing Bridge (1)	Situation of Existing Bridge (2)
 Since it passed approximately 38 years since the existing bridge was constructed, cracks and exposed rebar can be found at slab and abutment.	 Repair work was temporarily made by using soil bags at the abutment.
Situation of Existing Irrigation Canal (1)	Situation of Existing Irrigation Canal (2)
 Pavement detrioration due to water leakage from the surface of aging structure can be seen.	 Siphone type box culvert is installed as irregation channel.
Intersection at the Entrance of Bokhtar City (1)	Intersection at the Entrance of Bokhtar City (2)
 Traffic congestion can be observed in the intersection since there is no traffic signals, particularly in the peak hours.	 Chronic traffic congestion occurs during traffic peak time from 4 to 6 PM.

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LIST OF ABBREVIATIONS AND ACRONYMS

AADT	:	Annual Average Daily Traffic
AASHTO	:	American Association of State Highway and Transportation Officials
ADB	:	Asian Development Bank
AH	:	Asian Highway
ARAP	:	Abbreviated Resettlement Action Plan
CAREC	:	Central Asian Regional Economic Cooperation
CEP	:	Committee of Environmental Protection
CBR	:	California Bearing Ratio
DB	:	Dushanbe – Bokhtar
D/D	:	Detailed Design
EA	:	Environmental Assessment
EBRD	:	European Bank for Reconstruction and Development
EIA	:	Environmental Impact Assessment
E/N	:	Exchange of Notes
ESAL	:	Equivalent Single Axle Loadings
G/A	:	Grant Agreement
GOJ	:	Government of Japan
GOST	:	Gosudarstvennyy Standart [Set of Technical Standards Used in the Auspices of the Commonwealth of Independent States (CIS)]
GOT	:	Government of Tajikistan
GDP	:	Gross Domestic Product
IC/R	:	Inception Report
IDB	:	Islamic Development Bank
IEE	:	Initial Environmental Examination
IFC	:	International Finance Corporation
IOL	:	Inventory of Loss
IMF	:	International Monetary Fund
JICA	:	Japan International Cooperation Agency
KBA	:	Key Biodiversity Area
LOS	:	Level of Service
MOF	:	Ministry of Finance

MOI	:	Ministry of Industry
MOT	:	Ministry of Transport
NDS	:	National Development Strategy to 2030
O/D	:	Outline Design
OVOS	:	Otsenka vozdeystviya na okruzhayushchuyu sredu
PAPs	:	Project Affected Persons
PIU	:	Project Implementation Unit
RAP	:	Resettlement Action Plan
RCS	:	Replacement Cost Study
R/D	:	Record of Discussion
ROW	:	Right of Way
SEE	:	State Ecological Expertise
SEHM	:	State Enterprises on Highway Maintenance
SETM	:	State Enterprises for Transport Management
SHM	:	Stakeholder Meeting
SNiP	:	Stroitelnye Normary I Pravila [Russian Construction Codes and Regulations]
T/N	:	Technical Notes
WB	:	World Bank
WG	:	Working Group
WHO	:	World Health Organization

CHAPTER 1 Background of the Project

1.1 Introduction

Road network plays a vital role in the socio-economic growth of Tajikistan, as 92% of domestic freight and 98% of passenger transport rely on roads. It is an economic axis for domestic and international logistics. Dushanbe - Bokhtar Road (DB Road) is an arterial road which is positioned as one of the most important routes in Tajikistan. In addition, the DB Road is a part of the Asian Highway No.7 (AH7) as well as a part of Central Asia Regional Economic Cooperation (CAREC) 6 which is the international corridor that has been initiated by ADB to develop the high standard road network in Asia.

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1.2 Requested Scope

The request made by GOT is to rehabilitate 9.2km of the Kizilkala – Bokhtar section of Dushanbe – Bokhtar road, by widening of two lanes to four lanes and improving existing road facilities.

1.3 Environmental and Social Considerations

1.3.1 Environmental Impact Assessment System in Tajikistan

There are 3 laws stipulating objectives, assessment procedures and evaluation procedures necessary for development projects to obtain clearance from the standpoint of environmental and social considerations.

- The Law on Environmental Protection
- The Law on Environmental Expertise
- The Law on Environmental Impact Assessment

By observing the laws, it is a requirement to conduct environmental impact assessment by completing the two components; Environmental Impact Assessment (hereafter referred to as the OVOS) and State Ecological Expertise (hereafter referred to as the SEE). This system is slightly different from the conventional environmental impact assessment (hereafter referred to as the EIA) prevalent in Europe and North American countries, in that collection of information and documents required under the EIA

is conducted in accordance with the OVOS and the SEE covers the analysis, evaluation and approval procedures of the EIA.

The overall procedure on environmental impact assessment is stipulated in the governmental resolution no, 464 Regulation on Environmental Impact Assessment issued on 3rd October 2006 as indicated in Figure 1.3-1. In the regulation, Schedule 1 is appended in which there a list of 14 projects requiring the EIA are including highways.

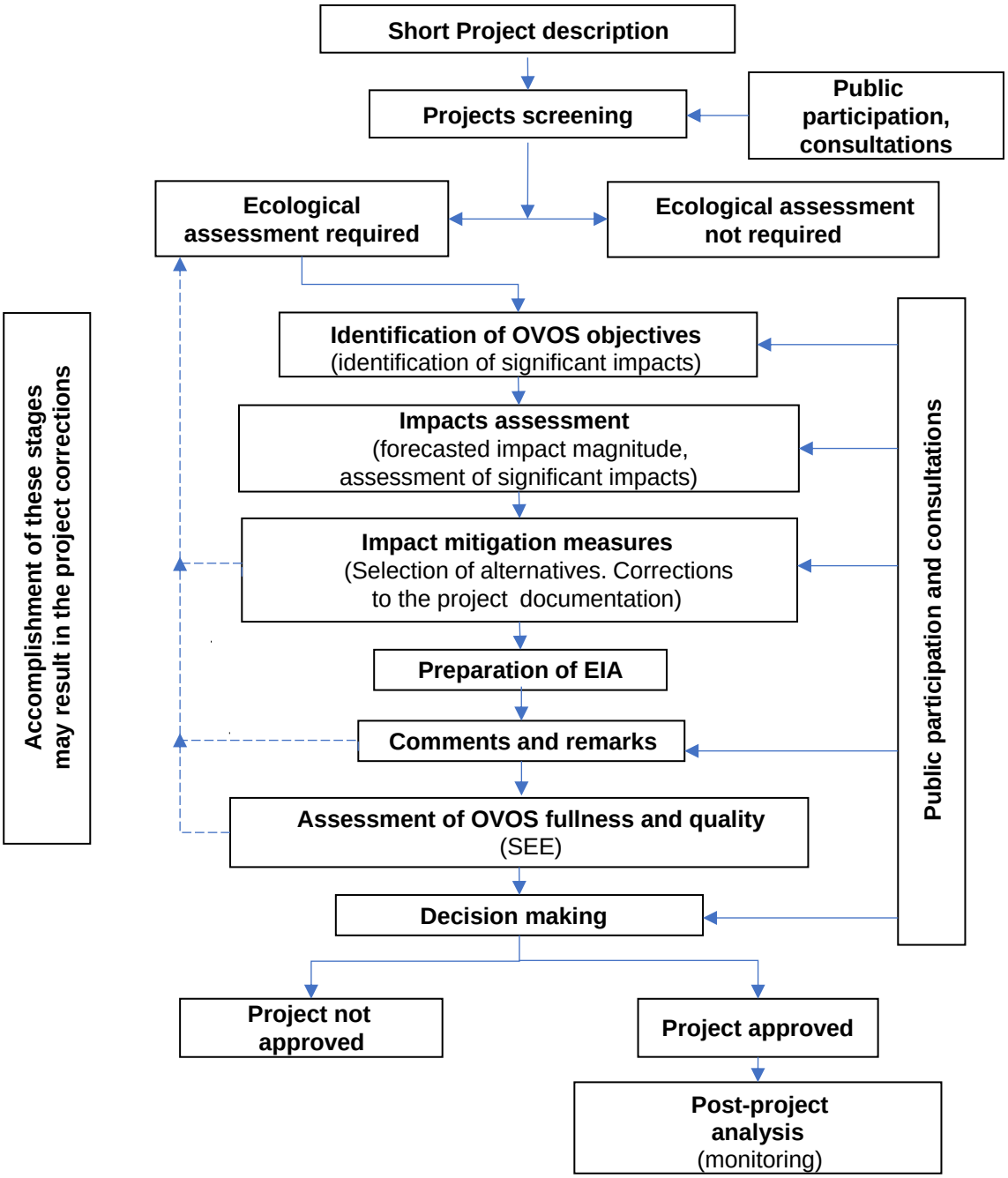


Figure 1.3-1 Environmental Impact Assessment Flow

On the other hand, Law on Environmental Impact Assessment (2017) defines criteria of classification of projects with consideration of seriousness of project impact. The law indicates four categories shown in Table 1.3-1.

Table 1.3-1 Criteria of Classification of Project

Category	Project	Procedure of Environmental Assessment
A	・The assessed object poses a negative and scale impact on the environment and (or) sanitary and hygienic well-being of the population ・The assessed object poses a direct impact on specially protected natural areas, which are protected by environmental conventions and other international agreements or having a different international status ・The assessed object poses a direct impact on the objects of historical and cultural heritage ・the assessed object has a transboundary impact	・Mandatory environmental impact assessment, when making decisions on carrying out the economical or other activity, including the decision to break off ・The acceptability of the negative impact on the environment, based on the standards for environmental safety, established (specified) in technical regulations ・Ensuring reduction of the negative impact on the basis of the use of the best available technologies, taking into account the feasibility of their adoption, rational use of natural resources and compliance with technical regulations in the field of environmental protection
B	Project that have a predictable impact on the environment and this is confirmed by the results of previous assessments.	Following features should be considered; the location of object, the presence and degree of vulnerability of near-shore zones, reserves and other protected areas, as well as the objects of historical and cultural heritage, the significance of environmental impact, its geographical distribution, duration and return.
C	Project that have a predictable impact on the environment and this is confirmed by the results of previous assessments.	Environmental impact statement shall contain an assessment of the types of environmental impacts (emissions into the atmosphere and discharges into water sources, generation and disposal of solid and liquid wastes, noise and other effects) typical for the economical or other activity.
D	Project that have a slight negative impact on the environment and the issues of reducing this impact are solved by engineering measures.	A mandatory requirement is the compliance of the profile of activity with the purpose of the General territory plan

Committee for Environmental Protection under the Government of the Republic of Tajikistan (CEP) is one of the government offices, and responsible for environmental protection in Tajikistan. CEP has decided that this Project fell into category B, because the negative impact of the Project seemed not much so that it was rehabilitation of existing road in shorter distance.

The IEE report of the Project had been submitted to CEP, and it was approved on 27th November 2018.

1.3.1.1 Other Environmental Permissions

The permissions are not required for borrow pit and spoil-bank because of the use of existing facilities. On the other hand, CEP put the conditions for legal effectiveness of the IEE report, which requested to obtain approval of State Environmental Appraisal of environmental management plans of construction of waste dumping site and asphalt plant. These permissions will be necessary, if a contractor doesn't use existing facility. In such case, the contractor will take necessary permissions prior to commencement of construction work with the help of MOT (Ministry of Transport).

1.3.2 Baseline of the Environmental and Social Considerations

1.3.2.1 Natural Environment

(1) Natural Environment

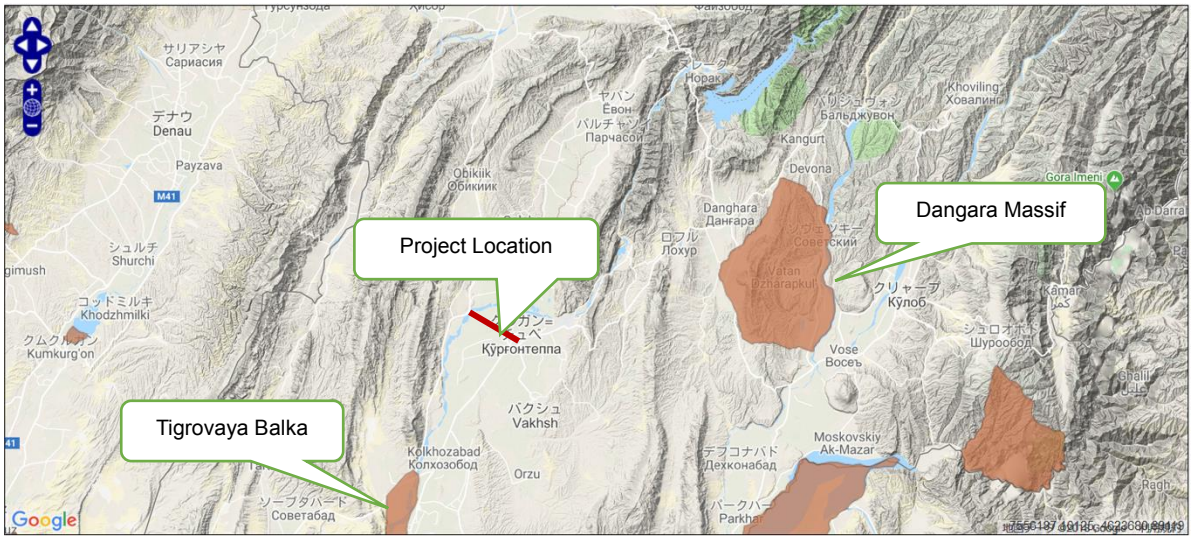
Tajikistan is blessed with natural environment owing to its terrains being partly under rolling and undulating topography and most of the region being mountainous. The Project is located at the comparatively lowland river floodplain area where the population is concentrated, and the land is either urban or cultivated farmland.

Water resource is abundant with existence of glaciers and ice fields in mountainous regions becoming the source. More than 70% is being used for irrigation purpose.

(2) Protected Area

There are 17 designated protected areas, 5 Ramsar sites, 2 national parks and 1 natural park in Tajikistan with none located at the Project or vicinity thereof. The nearest protected area is the Tigrovaya Bakla nature protected area which is located more than 40km away from the Project area.

In addition to the above, there are 18 locations designated as the Key Biodiversity Area (hereafter referred to as the KBA) in Tajikistan and all are an importance bird area. The nearest KBA is the Tigrovaya Bakla nature protected area and the next is the Dangara Massif nature protected area, both of which are more than 40km away from the Project. Please refer to Figure 1.3-2.



Source：World Database of Key Biodiversity Areas

Figure 1.3-2 Nature Protected Areas and KBA

1.3.2.2 Social Environment

(1) Local Administrations

The Project is located within the jurisdiction of 2 local administrative authorities; Bokhtar City and Kushoniyon District at Khatlon State. In Bokhtar City, 4 Mahals (local communities), Dusty, U. Khayam, Hyotinav and Vakhdat are involved. In Kushoniyon District, 3 villages in Oriyon Jamot and 5 villages in Bokhtarion Jamoat are involved. In Figure 1.3-3, yellow lines indicate administrative jurisdiction boundaries and red lines indicate jurisdictions of villages.

Figure 1.3-3 Administrative Boundaries

The population and the areas of farmland are summarized in Table 1.3-2.

Table 1.3-2 Population and Farm Land Area

City/District	Jamoat	Communities	Households	Population			Farm Land(ha)	
				Total	Male	Female	Total	Irrigated
Bokhtar	Total of Bokhtar City		18,838	111,049	55,637	55,412	626	592
		Dusti	263	1,536	770	766		
		U. Khayam	1,307	6,875	3,055	3,820		
		Hayoti- Nav	294	2,180	1,136	1,044	3	
		Vakhdat	1,001	3,973	2,016	1,957		
Kushoniyon	Total of District		27,173	—	—	—	22,216	21,946
	Oriyon Jamoat		1,558	12,002	6,111	5,891	930	930
		Okoltin	42	341	203	138	75	75
		Qahramon	268	2,782	1,404	1,378	142	143
		M. Gioyed	478	3,487	1,765	1,732	250	250
	Bokhtariyon Jamoat		4,250	44,810	22,064	22,748	7,684	4,573
		Navobod	240	3,534	2,403	1,531	376.2	270
		Ortod	200	1,861	9,586	875	213	118
		Makhsumobod	67	598	304	294	208.9	101
		Chakikho	175	1250	675	576	259.1	145
		Bibikhuram	73	—	—	—	220.7	103

(2) Social Economy

Tajikistan is the second poorest nation in Central Asia. The national economy relies upon agriculture, aluminum production, hydropower energy and remittance from abroad. The population engaged in agriculture consists of 43% of the total workers and produces 28.6% of the national GDP. Based on the social economy survey conducted by the JICA Survey Team surveying the head of households excluding pensioners at the Project site, 75% indicated as working (11% in agriculture) and 17% indicated as out of job. The result is indicated in Table 1.3-3.

Table 1.3-3 Job Classification

Classification	Head of Households		Others in Households	
	Nos.	%	Nos.	%
Pensioners	133	23.4	260	9.1
Government Workers	68	12.0	144	5.0
Private Business Employee	7	1.2	21	0.7
Business Owner	51	9.0	101	3.5
Farmers	49	8.6	170	5.9
Landlords	3	0.5	13	0.5
Other Workers	152	26.8	471	16.4
Housewives	27	4.8	785	27.4
Students	3	0.5	647	22.6
Out of Job	75	13.2	256	8.9
Total	568	100	2868	100

Source：JICA Survey Team

(3) Land Use

The Project lies in the area mainly split into 1) the urban area of Bokhtar City and 2) the farm land area in 2 jamoats in Oriyon Jamoat and Bokhtariyon Jamoat. Most farmers grow cotton, grapes, plums, apples, cherries, pistachios and vegetables using irrigations systems.

Farming in Tajikistan adopts a system of Dehkan farming in which a farm is run by a multiple number of families. There are 6 Dehkan farms in the area mainly growing cotton and wheat.

(4) Noise Level

The Project lies in the area which is mainly farm land and on which residential units and commercial facilities are scattered along the road. As such, most of the source of noise and vibration is considered as being originated from traffic. There are no standards of vibration and no monitoring system in Tajikistan, therefore, any basic data of vibration is not available. The problem of vibration has not been reported by the interview.

The baseline data on noise level conducted between 8th to 14th of June 2018 is indicated in

Table 1.3-4. There is no environmental standard set for noise caused by traffic in Tajikistan. For reference purpose, points were surveyed adjacent to the road as well.

Table 1.3-4 Noise Level Baseline Survey

Daytime:07.00-23.00, Night Time:23.00-07.00

No	Locations	Noise Standard (dBA)		Center of Community (dBA)		Adjacent to the road (dBA)
		Daytime	Night Time	Daytime	Night Time	Daytime
1.	STA.810+80	75	75	45	41	62
2.	Hotel "Bokhtariyon", STA.800+500	55.0	45.0	43	40.1	59
3.	Bibi-Khurram village, STA.780+400	55.0	45.0	40	38	65
4.	Orthod village, STA.760+500	55.0	45.0	41	39	70
5.	Navobod village, STA. 74+50050	55.0	45.0	44	39	67
IFC guidelines						
	Residential; institutional; educational	55	45			
	Industrial, commercial	70	70			

Source：JICA Survey Team

All surveyed data were below the noise standard at all surveyed locations. The values surveyed adjacent to the road indicate higher values. However, there is no environmental standard set for noise caused by traffic adjacent to roads. In Japan, there is an environmental standard set for noise monitored within a space adjacent to trunk roads to be within 70 dBA at daytime and within 65 dBA at night time. Surveyed data results are all within these limits.

(5) Air Quality

The Project lies in the area which has not been industrialized and emission of pollutants from industrial production is considered marginal. As such, emission from vehicular engines is the major source for polluting air quality.

As there is no air quality monitoring station nearby, the baseline survey on air quality was conducted between 8th to 15th of June 2018 and the result is indicated in Table 1.3-5.

Table 1.3-5 Air Quality Baseline Survey

No.	Items		Tajikistan Environmental Standard (Maximum Acceptable Concentration), mg/m^3	IFC guidelines standards (WHO guidelines)	Hourly Average Values (mg/m$^{3)}$	
					Daytime 06:00-12:00	Night Time 12:00-05:00
1.	Total Suspended Solids	TSP	0,15	as PM10 0.07mg/m^3 (Annual average) 0.15mg/m^3 (daily average)	0,095	0,061
2.	Carbon Monoxide	CO	3,0	–	1,3	1,1
3.	Carbon Dioxide	CO_2	3900	–	1850,00	1250,00
4.	Nitogen Oxides	NO_X	0,085	as NO_2 0.04mg/m^3 (Annual average) 0.20mg/m^3 (daily average)	0,047	0,041
5.	Sulphuric Dioxide	SO_2	0,05	0.125mg/m^3 (daily average) 0.50mg/m^3 (10minutes value)	0,025	0,019
6.	Phenols	C_6H_6O	0,01	–	0,0083	0,0054
7.	Formalhydes	CH_2O	0,1	–	0,065	0,032

Source: JICA Survey Team

(6) Water Use and Quality

To refer the data of the Millennium Development Goal, the achievement of the ratio of sustainable access to safe drinking water in Tajikistan is 93% in urban area and 67% in rural area in 2015. People who don't receive the piped water supply use rain, river, irrigation water, or groundwater for domestic purpose of use.

There is no piped water supply system in the Project area, therefore, the residents mainly use rain water and irrigation water. Table 1.3-6 shows the result of water quality test in the vicinity of the Project area. The water quality of drainage did not meet the standards in some parameters, and it indicated the influence of domestic wastewater. The water quality of river water at the downstream of outlet of drainage was affected by the worse quality of drainage water,

Table 1.3-6 Water Quality Test Result

No	Parameter		Tajikistan standards Maximum permissible concentration		IFC Stan-dards (Treated sanitary sewage discharges	Japan Riverwater environ-mental standards (B category)	Sample				
			Hygiene	Fish industry			Irrigation canal upstream	Irrigation canal down stream	Drainage outlet to Vakhsh river	Vakhsh river upstream of drainage outlet	Vakhsh river downstream of drainage outlet
1	Temperature, ^{0}C		—	—		—	8.9	10.0	9.5	8.3	8.3
2	pH		6.5-8.5		6-9	6.5-8.5	5.84	6.05	6.34	6.36	6.70
3	Odor		2	2	—	—	odorless	odorless	odorless	odorless	odorless
4	Clearness, cm		1.5	1.5	—	—	15	16	0	29	1
5	Color		20	20	—	—	colorless	colorless	brown	colorless	pale yellow
6	Suspended solidmg/l		0.25	0.75	50	25	0.046	0.208	0.89	0.132	0.86
7	Residue on evaporation, mg/l		1000	1000	—	—	143	572	898	590	147.1
8	Chloride, mg/l		350	300	—	—	117.7	132.4	102.9	117.7	142.0
9	Nitrogen	Ammonia. mg/l	2.0	0.39	10 as total nitro-gen	—	0.25	0.28	0.65	0.02	0,21
10		Nitrite. mg/l	1.0	0.02		—	0.015	0.016	0.21	0.010	0,011
11		Nitrate. mg/l	10.2 (45-NO_3)	9.1		—	7.8	7.9	8.5	6.90	6,95
12	BOD_5, mg/l		3.0	3.0	30	3	2.8	3.8	24.2	2.6	15.8
13	Potassium permanganate consumption, mg/l		5.0	—	—	—	3.03	4.75	116.6	5.54	95.4
14	Phosphate, mg/l		3.5	3.5	2 as total phosphorus	—	1.8	1.9	3.3	1.6	1.7
15	Sulfate, mg/l		500	500	—	—	76	75	150	71.5	73.4
16	Zinc, mg/l		5	5	—	—	1.5	1.6	2.1	1.7	1.8
17	Dissolved Oxygen, mg/l		4-6 <	4-6 <	—	5 <	5.5	5.7	2.9	8.1	8.2

Source: JICA Survey Team

1.3.3 Scoping Result

The potential environmental and social impact of the Project is shown in Table 1.3-7 as the scoping result.

Table 1.3-7 Scoping Result

Category	No.	Impact	Evaluation		Reasons for Assessment
			Pre-Construction Phase/ Construction Phase	Operation Phase	
Pollution	1	Air Pollution	B-	B±	**Construction**：Operation of construction machinery and vehicles increases the amount of exhaust gas and dust and it is expected to worsen air quality. The Construction work may create congestion of traffic, and it will result in the increase of exhaust gas. The earthwork will generate dust. **Operation:** Increase of traffic will simply increase the total gas emission. On the other hand, the improvement of road condition and running performance of vehicles may relatively decrease the gas emission.
	2	Water Pollution	B-	D	**Construction**：There is possibility of earth washout from the construction site and it will affect rivers and canals near the site. **Operation:** The change of quantity and quality of rainwater discharge is not expected, thus, there is no negative impact.
	3	Solid Waste	B-	D	**Construction**：The construction waste will be generated, such as broken asphalt, concrete and surplus soil. Construction workers will generate domestic waste. **Operation:** The project will not generate solid wastes.
	4	Soil Pollution	B-	D	**Construction:** There is possibility of oil leakage from construction machinery and vehicle **Operation:** There is no activity to create soil pollution.
	5	Noise and Vibration	B-	B±	**Construction:** Operation of construction machinery and vehicles may increase noise and vibration. Considering the effect of vibration during construction, it is not significant due to less cut work in the project, and vibration generating work such as embankment work will be conducted in the unpopulated section. Furthermore, any problem has never been reported at the extent of preceding project of ADB thus the instrumental investigation will not be conducted. **Operation:** Increase of traffic volume and speed will simply increase noise and vibration. On the other hand, the improvement of road condition and running performance of vehicle may relatively decrease noise and vibration.
	6	Ground Subsidence	D	D	**Construction・Operation:** There is no activity related to changing topography and extraction of groundwater, thus the ground subsidence will not be expected.
	7	Offensive Odor	D	D	**Construction・Operation:** There is no activity to create offensive odor. .

Category	No.	Impact	Evaluation		Reasons for Assessment
			Pre-Construction Phase/ Construction Phase	Operation Phase	
	8	Sediment	B-	D	**Construction:** There is possibility of earth washout from the construction site and it will affect sediment conditions of rivers and canals near the site. **Operation:** There is no activity to affect the sediment.
Natural Environment	9	Protected Area	D	D	**Construction・Operation:** There is no particular protected area within the vicinity of the project area.
	10	Ecosystem	C	D	**Construction:** The project area is mainly urban area and cultivated area, therefore, it is not expected the existing ecosystem to be affected seriously. The existing ecosystem in the project area will be confirmed by the site survey. **Operation:** Because it is the project to improve existing road, the new segmentation of ecosystem will not occur. The impact is not significant.
	11	Hydrology	B-	B-	**Hydrology:** The effect on canals and drains crossing the road should be considered. **Operation:** Appropriate roadway drainage to the canals and drains should be considered.
	12	Topography and Geology	D	D	**Construction・Operation:** Construction work does not change topography and geology significantly.
Social Environment	13	Resettlement	B-	D	**Before construction:** The residential area is not major in the project site, and the targets of resettlements are not many. The target of resettlement of office building, commercial facilities and petrol stations will be surveyed. **Operation:** Further land acquisition and/or resettlement will not be expected.
	14	Poverty	C	D	**Construction：** The job opportunity of simple work will be created by the construction work, and poverty group also has the opportunity. Current poverty condition will be studied. **Operation：**The considerable impact on poverty group is not expected.
	15	Ethnic Minority and Indigenous People	C	D	**Construction:** The existence of minority in the target group of resettlement will be checked. **Operation:** The project area has been developed, therefore, the special consideration to ethnic minority and indigenous people is not required.
	16	Employment, Livelihood and Local Economy	B±	B+	**Construction：** The business of petrol stations, offices, stores, street vendors, etc. will be disturbed by the construction work. On the other hand, the temporary job opportunity will be created. Operation: The project will reduce the time for transportation and improve convenience. It will contribute to the improvement of the economy of the area.

Category	No.	Impact	Evaluation		Reasons for Assessment
			Pre-Construction Phase/ Construction Phase	Operation Phase	
	17	Land and Local Resource Usage	B-	B±	**Construction：** The land for agriculture will be transformed to the road and partially the local resource will be reduced. The roadside is used for the transfer of livestock, and it will be disturbed during construction. **Operation：** The improvement of traffic condition will contribute the more effective use of local resources. The road has a function of the community and resident use. The road widening may cause the disturbance on such function.
	18	Water Use	C	D	**Construction:** The current water use by water bodies in the project site should be surveyed and the impact of construction will be evaluated. **Operation:** There is no significant impact from the project.
	19	Existing Social Infrastructure and Services	B-	B-	**Construction:** The construction work will create problems of traffic congestion and disturbance of access to the facilities beside the road. **Operation：** The road crossing activities of pedestrians and livestock will be disturbed.
	20	Social Capital, Local Decision-making Bodies and Other Social Organizations	D	D	**Construction･Operation:** The considerable impact on the local social organizations is not expected because the project implementing area is developed already.
	21	Misdistribution of Benefits and Damages	C	C	**Construction･Operation:** The resettlement and land acquisition may effect on only target persons.
	22	Local conflicts of interest	C	C	**Construction･Operation:** The possibility of occurring conflicts at the resettlement and land acquisition should be examined.
	23	Cultural Heritage	D	D	**Construction･Operation:** There is no cultural heritage.
	24	Landscape	B-	D	**Construction：** The construction work at the city area may disturb the landscape temporary. **Operation：** It is expansion of the existing road, therefore, it will not make impact on the landscape.
	25	Gender	D	D	**Construction･Operation:** The considerable effect on gender is not expected.
	26	Children's right	D	D	**Construction･Operation:** In Tajikistan, Law on Protection of Rights of the Child was enacted in 2015 and child labor is prohibited by law. Therefore, it is assumed that no special considerable influence on children's rights will occur.
	27	HIV/AIDS and other infectious diseases	C	D	**Construction:** The effect of influx of construction worker shall be examined. **Operation：** The effect on infectious diseases are not expected.
	28	Working conditions (incl. occupational safety)	B-	D	**Construction：**The working conditions of construction workers should be considered. **Operation：**There is no component to make impact on working condition.

Category	No.	Impact	Evaluation		Reasons for Assessment
			Pre-Construction Phase/ Construction Phase	Operation Phase	
Others	29	Accidents	B-	B-	**Construction:** The considerations are necessary for the occupational safety and traffic accident caused by construction vehicles **Operation:** The rate of traffic accident may increase by the increased speed of vehicles and widening of road width. The pedestrian safety should be considered.
	30	Transnational impacts and climate change	D	D	The waste generated by construction is treated in Tajikistan. Impact of waste water is ignorable. Air pollution is limited. The transnational impacts and climate change are not expected.

Legends are

Scores:

A: Great impact expected.
B: Some impact expected.
C: Impact unknown; confirmation study required.
D: Slight impact; no study needed.

+: Positive impact; -: Negative impact

1.3.4 Main Mitigation Measures

(1) Environmental Pollution during Construction Phase

The contractor will prepare and strictly implement mitigation measures against environmental pollution. The supervising consultant shall monitor the environmental conditions and complaints from the local people. If troubles of some sorts occur, the supervising consultant shall direct the contractor to reconsider the construction technique and method.

(2) Temporary Lease of Land for Contractor

Ministry of Transport shall be responsible for allowing the contractor to lease temporarily a plot of land required for the Project.

(3) Resettlement

Authorities concerned shall prepare and strictly implement a proper Abbreviated Resettlement Action Plan (ARAP).

1.3.5 Environmental Management Plan

Table 1.3-8 and Table 1.3-9 are summary of the environmental management plan.

Table 1.3-8 Environmental Management Plan (Construction)

Item	Mitigation Measures	Implemented	Supervised	Cost borne by
Air Pollution	Generation of dust is minimized by the sprinkling water during work which may generate dust. Transportation of earth material by vehicles is managed by the coverage. All construction machinery and vehicles shall be registered and maintained to manage exhaust gas to meet the standards. Unnecessary idling is prohibited to reduce amount of emission. Open burning of the waste at construction site is prohibited. Air quality is monitored and reported regularly.	Contractor	MOT CEP	Construction. cost
Water Pollution	Turbid water at the facility such as asphalt plant is treated by the sedimentation pond to settle turbid material before discharge. Domestic waste water shall not discharge to irrigation canal. Contractor shall monitor water quality to check any symptom of oil spill or other contamination. In case of abnormal observation, the contractor shall take immediate action and check water quality. Water quality near the site is monitored and reported regularly.	Contractor	MOT CEP	Construction cost
Solid Waste	Contractor tries to recycle construct waste as much as possible. Waste is dumped at the dumping site authorized by Province or District. Mixing up with domestic waste is prohibited. Domestic waste is managed to follow the rule of general waste in the community and with payment.	Contractor	MOT Province or District	Construction cost
Noise and Vibration	Contractor shall use low noise equipment as much as possible. The working time is limited at daytime and working day. Monitoring at working time is conducted and confirmed to be in an acceptable range. Operator is guided proper operation procedure in order to reduce noise and vibration. Regular monitoring is conducted at the potential affected area such as residential area.	Contractor	MOT CEP	Construction cost
Land and Local Resource Usage	MOT is responsible for the preparation of temporary land for construction work.	MOT	Local Govern-ment	GOT budget
Existing Social Infrastructure and Services	Residents near the construction site shall be informed about expected traffic congestion and/or detour by the construction by use of signboard, flagger and appropriate public information in order to minimize the effect. Relocation of utilities shall be conducted with plan and discussions.	Contractor	MOT	Construction cost

Item	Mitigation Measures	Implemented	Supervised	Cost borne by
Landscape	In case of complaint at the urban area for landscape problem, contractor shall take action such as use of temporary enclosure.	Contractor	MOT	Construction cost
HIV/AIDS and other infectious diseases	Contractor shall hold training program of awareness raising to prevent occurrence of infectious diseases.	Contractor	MOT	Construction cost
Working conditions (incl. occupational safety)	Training program of occupational safety to the workers shall be held regularly. Necessary safety tool is provided.	Contractor	MOT	Construction cost
Accidents	Traffic plan for the construction vehicle shall be prepared with the consideration of road safety. Training of traffic safety is conducted to prevent the accident.	Contractor	MOT	Construction cost

Table 1.3-9 Environmental Management Plan (Operation)

Item	Mitigation Measures	Implemented	Supervised	Cost borne by
Air Pollution	MOT continues appropriate operation and management of the road to keep the good and smooth driving condition to reduce the generation of pollutant. MOT/CEP will start national level monitoring of ambient air quality and strengthening regulations of exhaust gas if necessary.	MOT/CEP	GOT	GOT budget
Noise	MOT continues appropriate operation and management of road to keep the good and smooth driving condition to reduce the noise. MOT shall measure the noise level when complaint reports, and take actions to reduce noise level by strengthening speed limit.	MOT	Local Govern-ment	Not necessary
Existing Social Infrastructure and Services	MOT monitors pedestrians, especially children and vulnerable people, to check for problems in walking and crossing the roads and implements safety measures if necessary.	MOT/Traffic police	Local Govern-ment	MOT budget
Accidents	MOT monitors the trend of traffic accidents after the Project, and strengthens traffic regulations and/or holds awareness raising program if necessary.	MOT/Traffic police	Local Govern-ment	MOT budget

1.3.6 Environmental Monitoring Plan

The environmental monitoring plan and draft form are shown in Table 1.3-10 to Table 1.3-13.

Table 1.3-10 Environmental Monitoring Plan (Construction)

Category	Environmental Items	Monitoring Procedures	Reference Standard or Acceptance	Monitoring Locations	Frequency	Responsible Body
Air Pollution Control	Dust	Visual Inspection	Check for Abnormality	Site	Daily	Contractor
	Vehicle Emission Condition	Confirmation on Maintenance Record of Registered Construction Vehicles and Machineries	Check for Acceptance	Site Project Office	Monthly	Contractor
	Air Quality	TSP, CO2, NOx and SO2 Measurement by 3rd Party Laboratory	Tajikistan Air Quality Standard	Site	Quarterly	Contractor
Noise Control	Noise	Measurement by 3rd Party Laboratory	Tajikistan Noise Standard	Boundary of Neighboring facilities or Inside Affected Facilities	Quarterly	Contractor
	Noise and Vibration	Record of Construction Works during Night Time	Check for Acceptance	Site	Weekly during Construction	Contractor
Water Pollution Control	Turbidity and Oils	Visual Inspection	Check for Abnormality	Intake Point Downstream of Site	Daily	Contractor
	Water Quality	pH, EC, COD, turbidity, oil content and chemical analysis (by 3rd party laboratory)	Data Comparison between Upstream and Downstream	Upstream and Downstream of Drain Channels at Site	Quarterly	Contractor
Domestic Wastes	Waste Management	Visual Inspection by Patrolling	Check for Acceptance	Domestic Waste Locations	Weekly	Contractor
Construction Wastes	Waste Management including Final Dumping	Visual Inspection	Check for Acceptance including proper final dumping	Temporary Stockpile Locations	Upon Dumping	Contractor
Land Use and Regional Resources Utilization	Land Lease Condition	Lease Agreement	Check for Acceptance	Site Project Office	When the Lease Contract is Concluded	MOT
Existing Social Infrastructure and Services	Traffic Mitigation Measures during Construction	Project Monthly Report and Grievance Report	Check for Acceptance	Site Project Office	Monthly	Contractor
Landscape	Landscape Conservation Measures	Project Monthly Report	Check for Acceptance	Site Project Office	Monthly	Contractor
Infectious Diseases such as HIV/AIDS	Safety and Health Management	Project Monthly Report	Check for Acceptance	Site Project Office	Monthly	Contractor
Working Conditions	Safety and Health Management	Project Monthly Report	Check for Acceptance	Site Project Office	Monthly	Contractor
Industrial Accidents	Safety and Health Management	Project Monthly Report		Site Project Office	Monthly	Contractor

Table 1.3-11 Environmental Monitoring Plan (Operation)

Category	Environmental Items	Monitoring Procedures	Reference Standard or Acceptance	Monitoring Locations	Frequency	Responsible Body
Air Pollution Control	Air Quality	TSP, CO2, NOx and SO2 Measurement by 3rd Party Laboratory	Tajikistan Air Quality Standard	Country wide	Annual	MOT/CEP
Noise Control	Noise	Measurement by 3rd Party Laboratory	Tajikistan Noise Standard	Boundary of Neighboring facilities or Inside Affected Facilities	Time to receive complaint	MOT
Existing Social Infrastructure and Service	Disturbance of walking and crossing the road	Hearing	Acceptability is determined with community	Extent of the road of the project	Annual	MOT
Accident	Number of accident with cause	Trend analysis of accident and cause	Comparison with national average	Extent of the road of the project	Annual	MOT/ Traffic police

Table 1.3-12 Environmental Monitoring Form (Construction)

Monitoring Item		Procedure	Date/Result	Reference standard		Place	Frequency	Responsible Agency
Dust		Visual inspection		Acceptable or not		Construction site	Daily	Supervision Consultant, Construction Contractor
Vehicle condition		O & M record		Stated standards in EMP		Construction office	Monthly	Supervision Consultant, Construction Contractor
Air Quality	TSP	Laboratory test		0.15	Tajikistan standard	Construction site	Quarterly	Supervision Consultant, Construction Contractor
	CO2			3,900				
	NOx			0.085				
	SO2			0.05				
Noise (A-weighted equivalent sound level in dB)		Test by expert		55 (daytime) 45(nighttime)	Tajikistan standard	Construction site	Quarterly	Supervision Consultant, Construction Contractor
Noise and vibration		Operation time check		Stated operation time in EMP		Construction office	Weekly	Supervision Consultant, Construction Contractor
Water Quality (turbidity, oil)		Visual inspection		Acceptable or not		Construction site	Daily	Supervision Consultant, Construction Contractor
Water Quality	pH	Laboratory test		6.5 – 8.5	Tajikistan standard,	Irrigation canal near construction site	Quarterly	Supervision Consultant, Construction Contractor
	EC			1,000				
	COD			5.0				
	SS			0.25				
	DO			Not less than 4-6				
	Coli.			1,000				

Monitoring Item	Procedure	Date/Result	Reference standard	Place	Frequency	Responsible Agency
Waste (Domestic)	Patrol		Acceptable or not	Construction camp	Weekly	Supervision Consultant, Construction Contractor
Waste (Constriction)	Patrol		Acceptable or not	Dumping yard	Monthly	Supervision Consultant, Construction Contractor
Land Use	Lease condition		Acceptable or not	Construction office	Contract of lease	MOT
Traffic management	Patrol		Stated procedure in EMP	Construction site	Monthly	Supervision Consultant, Construction Contractor/ MOT
Landscape	Patrol		Stated procedure in EMP	Construction site	Monthly	Supervision Consultant, Construction Contractor
Infectious disease	Training		Stated procedure in EMP	Construction office	Monthly	Supervision Consultant, Construction Contractor
Accident	Patrol		Acceptable or not	Construction office	Monthly	Supervision Consultant, Construction Contractor
Claim and comment	Report check		Acceptable or not	Construction office	Monthly	Supervision Consultant, Construction Contractor

Table 1.3-13 Environmental Monitoring Form (Operation)

Monitoring Item		Procedure	Date/Result	Reference standard		Place	Frequency	Responsible Agency
Air Quality	TSP	Laboratory test		0.15	Tajikistan standard	Road side	Annual	MOT/CEP
	CO2			3,900				
	NOx			0.085				
	SO2			0.05				
Noise (A-weighted equivalent sound level in dB)		Test by expert		55 (daytime) 45(nighttime)	Tajikistan standard	Concerning place	When complaint is raised	MOT
Problem related to pedestrian		Hearing		Acceptance level is determined with stakeholders		Road side	Annual	MOT
Traffic accident		Data analysis		Comparison with national level		Road extent of the project	Annual	MOT/Traffic police

1.3.7 Stakeholders' Meeting

The stakeholders' meeting with relevant organizations, business enterprises and residents were held on 9 occasions from 16 May to 17 August 2018 as indicated in Table 1.3-14. As a result of stakeholder meeting, there is no opposition to the project.

Table 1.3-14 Summary of Stakeholders' Meeting

Stakeholders	Date/Venue	Participants	Method	Contents of Meeting
Bokhtar City	2018/5/16 At City Office Conference Room	City officials and JICA Survey Team Total 15 persons	Meeting	Presentation was made by the JICA Survey Team on the proposed project and the contents of study involved and requested for cooperation by Bokhtar City. JICA Survey Team and the city confirmed on the organizational set up from the city side. The city side informed that the city anticipated for economic impacts through the project and hoped for earliest completion. The city would provide necessary cooperation for smooth implementation.
Kushoniyon District	2018/5/17 Community Office	District officials and JICA Survey Team Total 7 persons	Meeting	Presentation was made by the JICA Survey Team on the proposed project and the contents of study involved and requested for cooperation by Kushoniyon District. JICA Survey Team and the district confirmed on the organizational set up from the district side. The district side disclosed that the district would support the project. There was a request not to disturb the graveyard.
Roadside Vendors	2018/5/16、17 On Site	Interview with 2 vendors	Interview	Vendors selling fruits and vegetables were interviewed and they confirmed that they were farmers from nearby and were selling their produces by establishing a temporary stand. They already knew about the project and welcomed the road widening. They said that their locations were temporary and had no concerns on project implementation.
Committee of Environmental Protection (CEP)	2018/5/23 CEP Conference Room	CEP Deputy Chairman, Head of International Cooperation Department, Head of Environmental Protection and JICA Survey Team	Meeting	Presentation was made by the JICA Survey Team on the proposed project and the contents of study involved. Hearing was conducted on environmental approval procedures and how information was publicized. The environmental category could not be determined, but it was made clear that IEE/EIA report must be submitted. They understood that Improvement on road networks was vital for the country and CEP would cooperate on the project.

Stakeholders	Date/Venue	Participants	Method	Contents of Meeting
Kushoniyon District	2018/5/25 Chakiho Village Community Hall	District officials, MOT officials, residents and JICA Survey Team	Open Meeting with Residents	Environmentalist explained the result of scoping about environmental and social impact expected by the project. Although residents welcomed the road improvement project, their major interest was on how compensation would be made.
Bokhtar City	2018/5/28 Bokhtarion Hotel	Deputy Mayor, City officials, MOT officials, residents and JICA Survey Team	Open Meeting with Residents	Environmentalist explained the result of scoping about environmental and social impact expected by the project. Although residents welcomed the road improvement project, their major interest was on how compensation would be made.
Ministry of Industry (MOI)	2018/5/29 Licensing Department of MOI	MOI licensing department officials (2 persons) and JICA Survey Team	Hearing	A hearing was made on borrow pit approvals, costs and the extent of responsibility involved. The JICA Survey Team confirmed on procedures required for new borrow pit development and costs involved.
Bokhtar City	2018/8/16 Bokhtarion Hotel	Deputy Mayor, City officials, MOT officials, residents and JICA Survey Team	Open Meeting with Residents	MOT explained about the design of the project and environmentalist explained the environmental and social survey result. Although residents welcomed the road improvement project, their major interest was on how compensation would be made.
Kushoniyon District	2018/8/17 Chakiho Village Community Hall	District officials, MOT officials, residents and JICA Survey Team	Open Meeting with Residents	MOT explained about the design of the project and environmentalist explained the environmental and social survey result. Although residents welcomed the road improvement project, their major interest was on how compensation would be made.

1.3.8 Land Acquisition and Resettlement

1.3.8.1 Range of Impact

The population census of the Project affected people was conducted in May, July and August 2018. The result is summarized in Table 1.3-15

Table 1.3-15 Population Census Result

District/ city	Number of household	Number of people	Male	Female	Female headed	Number of disabled	Number of vulnerable
Kushoniyon	81	756	364	392	3	8	1
Bokhtar	31	273	129	144	5	4	7
Total	112	1029	493	536	8	12	8

Source: JICA Survey Team

The identified affected residential units, structures and other private properties are shown in

Table 1.3-16. Tree residential units require relocation. The temporary use of land during construction will be required but no temporary relocation.

Table 1.3-16 Units Requiring Relocation and Other Partially Affected Structures

Structures	Quantity (Alongside Road)		
	Right Side	Left Side	Total
Residential Unit for Relocation	0	3	3
Other Residential Units Partially Affected (Roofs, Walls, Fence, Outside WC and Cattle Sheds)	10	14	24
Petrol Stations Partially Affected (Property, Roofs, Storage, Fence and Advertising Board)	7	3	10
Shops	1	0	1
Shops Partially Affected (Property, Roofs and Fence)	2	2	4
Restaurant Partially Affected (Fence, Roofs and Kitchen Built Outside)	0	1	1
Warehouse Partially Affected (Property)	1	0	1
Pond	1	0	1
Car Garage Partially Affected (Roof)	1	0	1
Total	23	23	46

Source: JICA Survey Team

The identified affected fruit bearing trees and households involved are shown in Table 1.3-17.

Table 1.3-17 Affected Fruit Bearing Trees List

No.	Types	Households	Trees	Households	Trees
		Fully Grown (for harvesting)		Not Yet Fully Grown (not for harvesting)	
1	Apricot	47	475	10	20
2	Cherry	33	255	14	57
3	Sweet cherry	11	59	2	1
4	Mulberry tree	32	191	4	11
5	Nutwood	23	155	7	23
6	Quince tree	4	9	0	0
7	Date-plum	14	54	3	10
8	Vineyard	11	64	2	4
9	Plum tree	9	102	1	2
10	Oleaster	7	65	0	0
11	Pomegranate	14	242	2	43
12	Peach	18	67	2	2
13	Apple	23	131	6	12
14	Fig	3	7	0	0
15	Almond	5	12	2	2
16	Lemon	2	18		
17	Pear	3	5	0	0
計		259	1,911	55	187

Source: JICA Survey Team

The identified affected non fruit bearing trees and households involved are shown in Table 1.3-18.

Table 1.3-18 Affected Non Fruit Bearing Trees List

No.	Types	Affected Households	Fully Grown Trees		Not Yet Fully Grown Trees
1	Firtree	23	198		39
2	Poplar	29	432		4
3	Pussy willow	58	1073		12
4	Plane tree	5	23		0
5	Ligusticum	1	6		0
6	Poplar	2	13		0
7	Acacia	3	22		0
Total		121	1767		55

Source: JICA Survey Team

The identified land properties, which will be partially affected are shown in Table 1.3-19.

Table 1.3-19 Affected Land Properties List

No.	Use	Household	Area (m^2)
1	Commercial	14	4,739
2	Residential	25	8,657
	Total	39	13,396

Source: JICA Survey Team

The identified affected farm land classified according to types of farm operation are shown in Table 1.3-20.

Table 1.3-20 Affected Farm Land Based on Farm Operation Types List

No.	Crops	Affected Farm Land by Operation Types				Affected Area(m2)			
		FDF	SF	PL	IDF	FDF	SF	PL	IDF
1	Vegetables	0	0	1	0	0	0	28	0
2	Grapes	0	0	0	0	0	0	0	0
3	Orchard	2	1	1	2	7,240	864	800	10,064
4	Corn	0	0	16	0	0	0	4,415	0
5	Wheat	0	0	0	0	0	0	0	0
6	Cotton	0	2	0	1	0	13,228	0	11,235
8	Rice	0	0	0	0	0	0	0	0
9	Grazing	0	0	10	0	0	0	461	0
	Total	3	4	30	3	9,910	14,602	5,958	21,299

FDF: Group Dehkan Farm SF：State Farm PL：Presidential Land IDF：Individual Dehkan Farm

Source: JICA Survey Team

1.3.8.2 Household and Livelihood Survey

The result of household and livelihood survey of the three relocating households are summited below.

Table 1.3-21 Household and Livelihood Survey Result

No.		1	2	3
Area		Kushoniyon district, Oniyon Jamoat	Bokhtar City	Bokhtar City
Number	Male	2	4	1
	Female	3	9	2
Vulnerable		2	2	2
Income/ month (Somonis)		900	1,300	936
Income source		Employment	Agriculture, pension, overseas remittance	Pension, employment
Asset		TV, oven, mobile phone, fan	TV, stove, mobile phone, fan	TV, mobile phone, fan, bicycle
Photo				

1.3.8.3 Vulnerable Households

Vulnerable people are defined as disabled person, woman headed household categorized as poor, elderly household without mean of livelihood. 17 households are identified as vulnerable group.

Table 1.3-22 Vulnerable Households

Category	Households	Family member
Disabled	10	130
Poor	7	41
Total	17	171

1.3.8.4 Support of Reconstructing Livelihood

The person subject to relocation will receive payment of 3 months of national average income as a supportive measure for reconstruction of livelihood. In addition, if there is vulnerable people, they will receive compensation for three months of national average income, priority employment for project related projects. If they are not registered in the social support system, they will receive support for registration.

1.3.8.5 Contents of Compensation and Assistance

The entitlement matrix is shown in Table 1.3-23. The policy for compensation and assistance under the Project as outlined in the table is in line with the policy already set out by the ADB Project. The cut off date for compensation and assistance was already fixed (as announced on 22 April 2016 and gazetted in newspapers) and it was confirmed through meetings with both Bokhtar city and Kushoniyon District officials that such a date was still the cut off date.

Table 1.3-23 Entitlement Matrix

Lost Properties and Rights	Targets	Project Affected Persons (PAP)	Entitlements
Temporary Loss of Land	Use of Land during Construction	Rightful Land User or Tenant	The loss of revenue from the land during the construction period will be determined based on market rates. When the land is returned, the land shall be returned to its original condition.
Loss of Land	Farm Land	Rightful Land User	Either cash compensation based on revenues earned in the last 5 years or provision of alternative land of equivalent value or productivity.
		Joint Rightful Land User	Ditto, above.
	Residential and Commercial Plots	Rightful Land User	As a loss of land use right, compensation equivalent to 25 years of land use tax and registration fee shall be paid.
Loss of Structures	Structures (Residential and Commercial)	Structure Owner（There are no squatters in the Project area）	The project affected person shall be compensated based on full replacement costs irrespective of both the depreciation value and replacement availability. When sourcing the alternative structure, he shall receive support as well. He may be entitled to receive an existing asset instead of cash.
Loss of Trees and Crops	Crops Grown within Affected Land	All	One-year worth of cash which is equivalent to the production value from the affected land shall be paid.
	Trees Grown within Affected Land	All	Revenues required until the replaced trees earn the equivalent profit shall be compensated. Materials such as replacing nursery trees and others shall be provided.
Relocation	Household Requiring Physical Relocation	All	In addition to the compensation cost of the structure additional costs for relocation (workers, vehicles, relocation for household goods), connection fees for electricity, water supply and sewerage shall be paid. 3 months worth of the average income shall also be paid to cover for living reconstruction expenses.
Partial or Complete Loss of Structures	Structures (Residential and Commercial)	Structure Owner（There are no squatters in the Project area）	The project affected person shall be compensated based on full replacement costs irrespective of both the depreciation value and replacement availability. When sourcing the alternative structure, he shall receive support as well. The relocation location must be determined before relocation. The support for relocation shall also be provided. In case, finding the relocation location can not be completed as an emergency case, the rental fee shall be paid until the relocation is completed.
Social Minorities	Social Minorities Living within Affected Land	Social Minorities Identified under Social Survey	Compensation equivalent to 3 months income based on the average monthly income shall be paid. In case, the person was not registered under the government social support program,

Lost Properties and Rights	Targets	Project Affected Persons (PAP)	Entitlements
			he shall be registered and shall have a preferential treatment for employment under project related businesses.
Removal and/or Relocation of Community Properties	Community Structures Located within Affected Land	Structures Identified under Social Survey	Repair or relocations of affected structures. Relocation cost maybe replaced by cash compensation.
Loss of Properties Not Indicated Above	Identified Loss Not Indicated Above but Identified during Detail Design	Affected Persons	The compensation policy shall be determined by ARAP and JICA Guideline.

Within the area covered, loss of land for business and commercial occurs but it is not significant and the loss for business and commercial entities are not expected, therefore, only compensation for land loss is calculated.

When the relocation occurs, the relocated households move to the new location and obtain the new land use right. The households should register and obtain certification of land use right and they are obligated to pay tax for land use every year. The compensation consists of payment of the registration fee and tax for 25 years. It is considered as replacement cost.

1.3.8.6 Monitoring Plan

The draft monitoring form of land acquisition and resettlement is shown in Table 1.3-24.

Table 1.3-24 Draft Monitoring Form of Land Acquisition and Resettlement

Preparation of Resettlement Site

No	Explanation of the Site	Status Completed (date) or not)	Details	Expected Date of Completion
1.				
2.				
3.				

Public Consultation

No.	Date	Place	Contents of the construction / Main comments and answers
1.			
2.			
3.			

Resettlement

Resettlement Activity	Planned Total	Unit	Progress in Quantity			Progress in %		Expected Date of Completion	Responsible Organization
			During the Quarter	Till the Last Quarter	Up to the Quarter	Till the Last Quarter	Up to the Quarter		
Preparation of ARAP*									
Employment of Consultants		Man-Month							
Implementation of Census Survey									
Approval of ARAP	Date of Approval:								
Finalization of PAPs List		No. of PAPs*							
Progress of Compensation Payment (All Lots)		No. of HHs*							

* PAP: Project Affected People

* HH: Household

1.3.9 Environmental Checklist

The environmental checklist is shown in Table 1.3-25 from the next page.

Table 1.3-25 Environmental Checklist

Category	Environmental Items	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
1 Permits and Explanation	(1) EIA and Environmental Permits	(a) Have EIA reports been already prepared in official process? (b) Have EIA reports been approved by authorities of the host country's government? (c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied? (d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	(a) N (b) N (c) Y (d) N	(a) (b) IEE report was prepared and submitted to CEP, and it was approved on 27th November 2018. (c) The document of appraisal contains the recommendations and the fulfillment is a condition of legal effectiveness. Most of all are general, and request of obtaining State Environmental Appraisal for dumping of construction waste and allocation of asphalt plant will be fulfilled by the contractor with the assistance of MOT. Therefore, conditions will be fulfilled. (d) N.A.
	(2) Explanation to the Local Stakeholders	(a) Have contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the Local stakeholders? (b) Have the comment from the stakeholders (such as residents) been reflected to the project design?	(a) Y (b) Y	(a) Presentations were made to CEP and local governments. Based on this, an agreement is obtained on project implementation. Stakeholders including residents in the Project site, implementing agency and local governments were invited in open meetings and understanding was obtained. (b) Request on safety measures have been catered to. Road alignment restudied based on requests on the graveyard and minimizing affected households.
	(3) Examination of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	(a) Y	(a) The road alignment which minimizes the affected area was selected based on various alternatives. By reflecting the masterplan prepared by Bokhtar City, the road within the Bokhtar Section was adjusted by narrowing the road width. Thus, the affected area was also reduced. The intersection alignment was selected from the design incorporating additional road safety.

Category	Environmental Items	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
2 Pollution Control	(1) Air Quality	(a) Is there a possibility that air pollutants emitted from the project related sources, such as vehicles traffic will affect ambient air quality? Does ambient air quality comply with the country's air quality standards? Are any mitigating measures taken? (b) Where industrial areas already exist near the route, is there a possibility that the project will make air pollution worse?	(a) Y (b) N	(a)(b) Based on the result of the baseline survey, the existing environmental standard is complied with. Compared to other Central Asian countries, Tajikistan had less registered vehicles and the proportion of LNG vehicles was higher. As such, the total volume of gas emission was considered less than other countries. On the other hand, the number of registered vehicles are on the increase owing to economic development. As such, it is deemed that the traffic volume using the Project road will increase and air pollutants generated form vehicular traffic is deemed to increase as well. However, when compared against the without case, vehicular traffic efficiency will improve due to the road improvement. Thus, it is expected that the total generated volume of pollutants will be reduced.
	(2) Water Quality	(a) Is there a possibility that soil runoff from the bare lands resulting from earthmoving activities, such as cutting and filling will cause water quality degradation in downstream water areas? (b) Is there a possibility that surface runoff from roads will contaminate water sources, such as groundwater? (c) Do effluents from various facilities, such as parking areas/service areas comply with the country's effluent standards and ambient water quality standards? Is there a possibility that the effluents will cause areas not to comply with the country's ambient water quality standards?	(a) N (b) N (c) N	(a) The annual precipitation at the Project area (Bokhtar City) is approximately only 270/year mm with the highest precipitation being 67mm/month. It is very difficult to assume that there would be rainfall with high rainfall intensity causing soil runoff. For embankment materials, aggregates from rive origin (sand) are planned for use. Because of high permeability, runoff of such materials is also assumed low. (b)The element of surface runoff is from rainfall. Such rainfall will be either permeated into ground or discharged through properly designed drainage channels. Hence, the possibility of surface runoff from roads contaminating water sources is low. (c)Parking areas and other facilities which may lead to effluents contamination is not planned in the Project.
	(3) Wastes	(a) Are wastes generated from the project facilities, such as parking areas/service areas, properly treated and disposed of in accordance with the country's regulations?	(a) N	(a) Parking areas and other facilities which may lead to generation of wastes is not planned in the Project.

Category	Environmental Items	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(4) Noise and Vibration	(a) Do noise and vibrations from the vehicle and train traffic comply with the country's standards?	(a) Y	(a) The existing environmental standard on noise level is complied with. Increase of traffic vehicles leads to increase of noise and vibration levels. On the other hand, the noise and vibration levels of each vehicle will decrease because of improvement of road surface conditions due to the road improvement. Thus, it is expected that the noise and vibration levels will be reduced if compared against the without case.
3 Natural Environment	(1) Protected Areas	(a) Is the project site located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	(a) N	(a) There are no protected areas within the vicinity of the Project area. There is no concern for the Project affecting the protected areas.
	(2) Ecosystem	(a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? (b) Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions? (c) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem? (d) Are adequate protection measures taken to prevent impacts, such as disruption of migration routes, habitat fragmentation, and traffic accident of wildlife and livestock? (e) Is there a possibility that installation of roads will cause impacts, such as destruction of forest, poaching, desertification, reduction in wetland areas, and disturbance of ecosystems due to introduction of exotic (non-native invasive) species and pests? Are adequate measures for preventing such impacts considered? (f) In cases the project site is located at undeveloped areas, is there a possibility that the new development will result in extensive loss of natural environments?	(a) N (b) N (c) N (d) N (e) N (f) N	(a) N.A. (b) N.A. (c) N.A. (d) As the Project is an improvement of the existing road, there will be no disruption and fragmentation to be caused. (e) As the Project is an improvement of the existing road and the widening is limited to the existing ROW, there will be no disturbance of ecosystems additionally caused. (f) As the Project is planned at developed areas, this does not apply.
	(3) Hydrology	(a) Is there a possibility that alteration of topographic features and installation of structures, such as tunnels will adversely affect surface water and groundwater flows?	(a) N	(a) Major alteration of topographic features and installation of structures such as tunnels are not planned in the Project.
	(4) Topography and Geology	(a) Is there any soft ground on the route that may cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides, where needed?	(a) N (b) N (c) N	(a)(b) There are no areas along the proposed road route that may have topographical and geological engineering concerns. Filling and cut works are limited to small scale and the possibility of such leading to slope failures and landslides is

Category	Environmental Items	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		(b) Is there a possibility that civil works, such as cutting and filling will cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides? (c) Is there a possibility that soil runoff will result from cut and fill areas, waste soil disposal sites, and borrow sites? Are adequate measures taken to prevent soil runoff?		low. (c) The possibility of soil runoff is low as the Project area lies in the low precipitation area.
4. Social Environment	(1) Resettlement	(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement? (b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement? (c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement? (d) Are the compensations going to be paid prior to the resettlement? (e) Are the compensation policies prepared in document? (f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, and people below the poverty line, ethnic minorities, and indigenous peoples? (g) Are agreements with the affected people obtained prior to resettlement? (h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan? (i) Are any plans developed to monitor the impacts of resettlement? (j) Is the grievance redress mechanism established?	(a) Y (b) Y (c) Y (d) Y (e) Y (f) Y (g) Y (h) Y (i) Y (j) Y	(a) Owing to the road widening, it is expected that 3 units and 10 persons would require resettlement. (b) During the stakeholders' meeting, affected persons were explained on compensation and resettlement assistance. (c) Abbreviated Resettlement Action Plan (ARAP) covers the result of socio economic studies on resettlement including the loss inventory for PAPs, compensation with full replacement costs and restoration of livelihoods and living standards (d) It is expected that compensation monies would be paid prior to the resettlement. (e) The compensation policies are stated in the ARAP. (f) The ARAP takes into consideration on social minorities. (g) A series of open meetings targeting residents at the Project area were held and agreements obtained. (h) An organizational framework on resettlement based on the ARAP was established and proper budgetary allocation is expected to be made. (i) Sections of the ARAP contain the plans on monitoring and evaluation. (j) A grievance redress mechanism was established, and the contents are presented in the ARAP.
	(2) Living and Livelihood	(a) Where roads are newly installed, is there a possibility that the project will affect the existing means of transportation and the associated workers? Is there a possibility that the project will cause significant impacts, such as extensive alteration of existing land	(a) N (b) Y	(a) It is expected that there would be no significant impacts to be caused by the Project as the nature of it is of improvement of the existing road.

Category	Environmental Items	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		uses, changes in sources of livelihood, or unemployment? Are adequate measures considered for preventing these impacts? (b) Is there any possibility that the project will adversely affect the living conditions of the inhabitants other than the target population? Are adequate measures considered to reduce the impacts, if necessary? (c) Is there any possibility that diseases, including infectious diseases, such as HIV will be brought due to immigration of workers associated with the project? Are adequate considerations given to public health, if necessary? (d) Is there any possibility that the project will adversely affect road traffic in the surrounding areas (e.g., increase of traffic congestion and traffic accidents)? (e) Is there any possibility that roads will impede the movement of inhabitants? (f) Is there any possibility that structures associated with roads (such as bridges) will cause a sun shading and radio interference?	(c) N (d) N (e) Y (f) N	(b) There will be resettlement, removal of fences etc. and reduction of farm land area, all of which will be compensated accordingly. (c) It is expected that there would be no influx of people from other regions as the nature of the Project is of improvement of the existing road. (d) Owing to the fact that the Project incorporates installation of central medians at the entire section, traffic will not be able to make U turns freely. This is mitigated by providing designated U turn locations at appropriate locations. (e) Owing to the fact that the road will be widened from 2 lanes to 4 lanes, it is expected that road crossing by inhabitants will become more dangerous. As such, safety measures such as designated road crossings and traffic lights will be taken. For the urbanized section, a measure to control the speed limit is being considered. (f) There is no possibility of sun shading and radio interference as the nature of the Project is of improvement of the existing road with only minor embankment works.
	(3) Heritage	(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws	(a) N	(a) There are no archeological, historical, cultural and religious heritages within the Project area and other areas affected by the Project.
	(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	(a)N	(a) The Project area is either urbanized or farm land. There are no local landscape which requires additional measures to be taken.
	(5) Ethnic Minorities and Indigenous Peoples	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples? (b) Are all the rights of ethnic minorities and indigenous peoples in relation to land and resources to be respected?	(a)N/A (b)N/A	(a)(b) There are no ethnic minorities and indigenous peoples with own culture and lifestyles living at the Project area.
	(6) Working Conditions	(a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the	(a)Y (b)Y	(a) The contract document will cover provisions on legal compliance.

Category	Environmental Items	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		project? (b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials? (c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.? (d) Are appropriate measures being taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or residents?	(c)Y (d)Y	(b) Safety installations and equipment for preventing industrial accidents, and safety training to workers will be provided by the contractor. Management of hazardous materials will be conducted by the contractor. (c) Periodical workshops to workers will be held on safety training including traffic safety and safety and health program by the contractor. (d) Security guards will participate in (c) above under supervision by the contractor.
5 Others	(1) Impacts during Construction	(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)? (b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts? (c) If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts? (d) If construction activities adversely affect the traffic, are adequate measures considered?	(a) Y (b) N (c) Y (d) Y	(a) Proper mitigation plan, such as the period of construction and construction methods and monitoring plans will be prepared and put into action during construction. (b) The Project does not include construction works which will adversely affect the natural environment. (c) (d) The impact will be minimized by taking measures such as introduction of diversions, securing access to existing facilities and securing sufficient traffic lanes by appropriate planning.
	(2) Monitoring	(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts? (b) What are the items, methods and frequencies of the monitoring program? (c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)? (d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	(a)Y (b)Y (c) Y (d) Y	(a) Monitoring program as elaborated in the IEE report will be implemented. (b) Items, methods and frequencies of the monitoring program are determined based on the potential impacts and the requests from the Tajikistan environmental administration office. (c) The framework will be covered under the contract document. (d)The draft monitoring plan in the IEE report covers the regulatory requirements.
6 Note	Reference to Checklist of Other Sectors	(a) Where necessary, pertinent items described in the Forestry Projects checklist should also be checked (e.g., projects including large areas of deforestation). (b) Where necessary, pertinent items described in the Power Transmission and	(a)N (b)N	(a) Deforestation is not necessary under the Project. (b)The Project does not interfere with power transmission and/or electric distribution facilities.

Category	Environmental Items	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		Distribution Lines checklist should also be checked (e.g., projects including installation of power transmission lines and/or electric distribution facilities).		
	Note on Using Environmental Checklist	(a) If necessary, the impacts to transboundary or global issues should be confirmed, if necessary (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	(a)N	(a) The impact to the transboundary issue is not envisaged.

CHAPTER 2 Contents of the Project

2.1 Basic Concept of the Project

2.1.1 Background

The international road connecting Dushanbe and Bokhtar (hereafter referred to as the DB Road) is one of the vital road within the Tajikistan road network. However, excluding the section under past ADB assistance, the pavement condition is rather poor and had been the bottleneck for the socio-economic growth of the country. As such, ADB has embarked on extending further assistance towards rehabilitation of the Dushanbe-Kizilkala section (hereafter referred to as the ADB Section) by widening the 72.8 km distance. The objective of the project being considered under the Preparatory Survey is to contribute in achieving socio-economic growth of Tajikistan by rehabilitating and securing the safe and smooth traffic along the Bokhtar-Kizilkala section of the DB Road (hereafter referred to as the Project Road).

As the Bokhtar-Nizhniy Panj section was rehabilitated in the past under Japanese grant aid assistance, upon completion of rehabilitation of both the ADB section and the Project Road (hereafter referred to as the Project), the entire length of the road from Dushanbe to the Afghanistan border will provide road users with a reliable, safe and comfortable road network, which would be the additional benefits of the Project.

2.1.2 Anticipated Outcome

The Project Road, which is the approximately 9.2 km section of the southern end section of the DB Road (Approximately 82.0 km) is rehabilitated and widened from two lanes to four lanes.

2.1.3 Project Outline

Project Outline	(1) Target:	The target is to contribute to development of socio-economic conditions of Tajikistan by rehabilitating Kizlikala – Bokhtar section of Dushanbe -Bokhtar Road, thus attaining safe and smooth traffic in the section.
	(2) Outcome:	The Project Road between Kizilkala to Bokhtar (Approx. 9.2 km) is rehabilitated and widened from two lanes to four lanes.
	(3) Location:	Khatlon State
	(4) Implementing Agency:	Ministry of Transport

2.2 Outline Design of the Requested Japanese Assistance

2.2.1 Survey Schedule and Project Scope

2.2.1.1 Preparatory Survey Schedule

In order to implement the Project properly and effectively under Japanese grant aid assistance, the Preparatory Survey was conducted as follows;

- April to June 2018： Consultation and discussion on IC/R and conducting first site survey
- June to November 2018: Outline design and cost estimation in Japan
- August 2018: Outline design consultation and discussion, conducting SHM, obtaining approval on the project scope, and conducting supplementary survey
- November 2018: final survey (Consultation and discussion on the draft final report)

2.2.1.2 Maintaining AH Carriageway Width Standard to be Consistent with Ongoing ADB Project

The DB Road is a designated Asian Highway (hereafter referred to as the AH) road and one of the most strategic trunk road in Tajikistan connecting Dushanbe, the capital city with Bokhtar, the most populous city in Khatlon State. The AH network other than the DB Road in Tajikistan crisscrosses Dushanbe in all 4 major orientations. Out of 4 orientations, AH65 which runs east to west of and the northern sector of AH7which extends north of Dushanbe have been rehabilitated recently with proper pavement conditions and functions as international roads. However, the DB Road which covers the southern orientation is in dire need of rehabilitation as the pavement condition is rather poor excluding the section under past ADB assistance. As such, ADB is currently implementing rehabilitation works on the ADB Section by widening the 72.8 km of DB road (82.0km) distance. The Project Road is the southern end section of the DB Road covering approximately 9.2 km. The start point of the Project Road connects to the end of phase 2 section of the ADB Section. The standard cross section at the end point of phase 2 section of the ADB section is indicated in Figure 2.2-1.

Considering road continuation of the DB Road and maintaining design parameter consistency between the Project and the ADB Project is of paramount importance. Under T/N concluded between the JICA Survey team and MOT, this standard cross section has been agreed to.

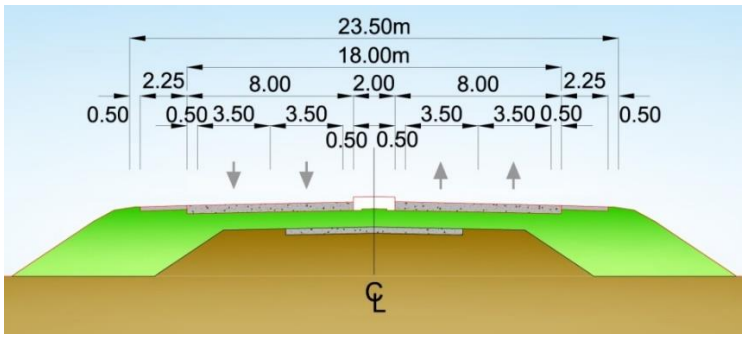


Figure 2.2-1 Standard Cross Section at the End Point of Phase 2 ADB Section

2.2.1.3 Maintaining Consistency with Bokhtar City Urban Development Plan

(1) Findings from Bokhtar City Urban Development Plan

The JICA Survey team checked the contents of Bokhtar City Urban Development Plan developed in 2011 and authorized by the President. A discovery was made that the 1.5 km end section of the Project Road (hereafter referred to as the Bokhtar Section) had been planned under this development plan as indicated in Figure 2.2-2.

Another discovery was that the development department of Bokhtar City office had sent to the Project Implementation Unit (hereafter referred to as PIU) of MOT a letter requesting for consideration for such development plan in place for any future road project in March 2017. The proposed completion of this development was set at 2035. However, at this stage, nothing concrete has been agreed with on financing of the development and other details.

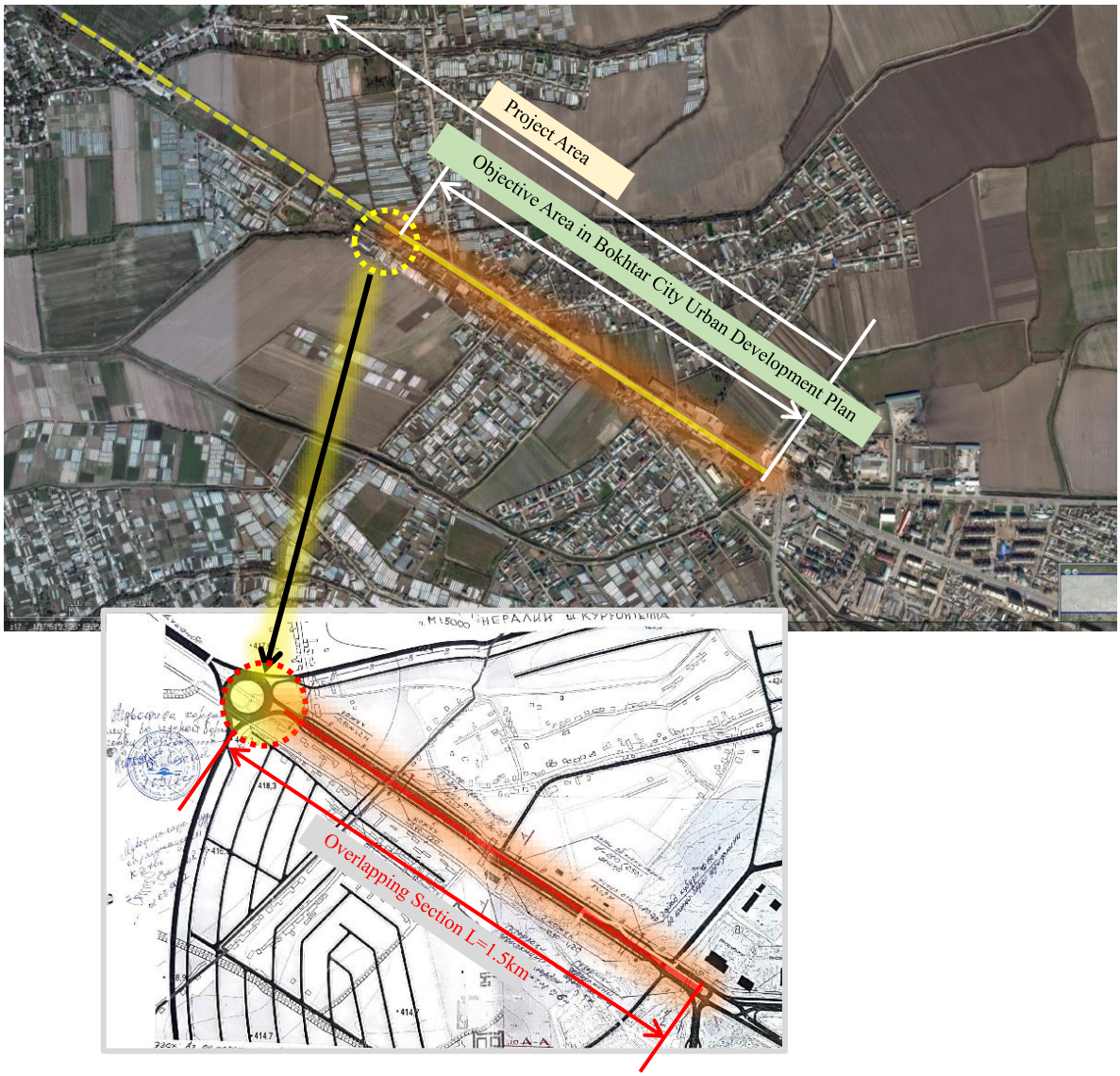


Figure 2.2-2 Bokhtar City Development Plan Compared with End 1.5 km Section of Project Road

Under the development plan, the road has been designed as a 6 lanes carriageway with the carriageway width of 24 m as indicated in Figure 2.2-3. The development department of Bokhtar City office requested to the JICA Survey team that the Project should take into consideration this development plan at the Bokhtar Section.

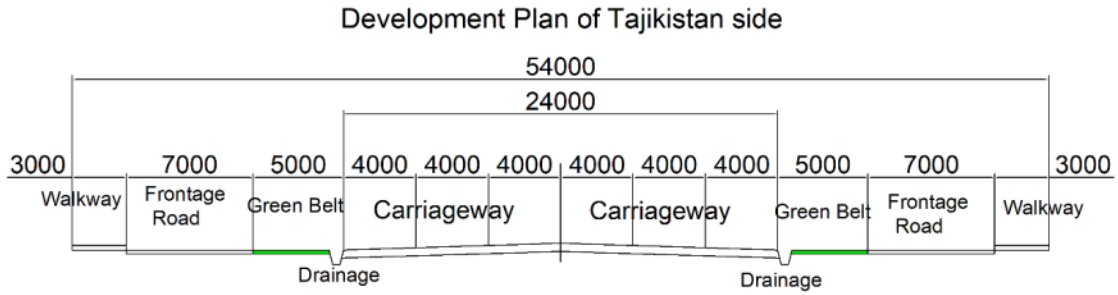


Figure 2.2-3 Road Cross Section under Bokhtar City Development Plan

(2) Considerations Necessary to Tie-in with Bokhtar City Urban Development Plan

Initially discussing this issue with the development department of Bokhtar City office, the JICA Survey team presented that the objective of the Project was to improve the traffic situation of the DB Road by widening the existing 2 lanes to 4 lanes in conjunction with the ADB Project. Additionally, the team presented that 1) there were no concrete decision made on how to fund and when to implement this development, though a target completion was set at 2035 and 2) it was highly unlikely to be able to justify necessities on 6 lane widening at the Bokhtar Section, forcing the team to judge that it would be rather difficult to accept this widening proposal by the Japanese side.

Since the development department of Bokhtar City office continually insisted that the 6-lane widening was the prerequisite and could not accept the 4-lane plan presented by the JICA Survey team, the team prepared the following proposal, and this was accepted by the development department of Bokhtar City office. The proposal became the agreed plan for this section.

- The Japanese side will design the road structure at the Bokhtar Section that would be compatible to the 6-lane planned by the Tajikistan side so that the structure is capable for use in case the development is implemented. However, the road would only be constructed as a 4-lane carriageway and the extent of the scope would be limited to the outer end of the drainage by the Japanese side. (The excess width of the road will be used as shoulders (deceleration lane) and sidewalks as a tentative measure.)
- As agreed under the 1st T/N, green belts, frontage roads and sidewalks under the development plan will be under the scope of the Tajikistan side.

The proposal by the JICA Survey team is indicated in Figure 2.2-4.

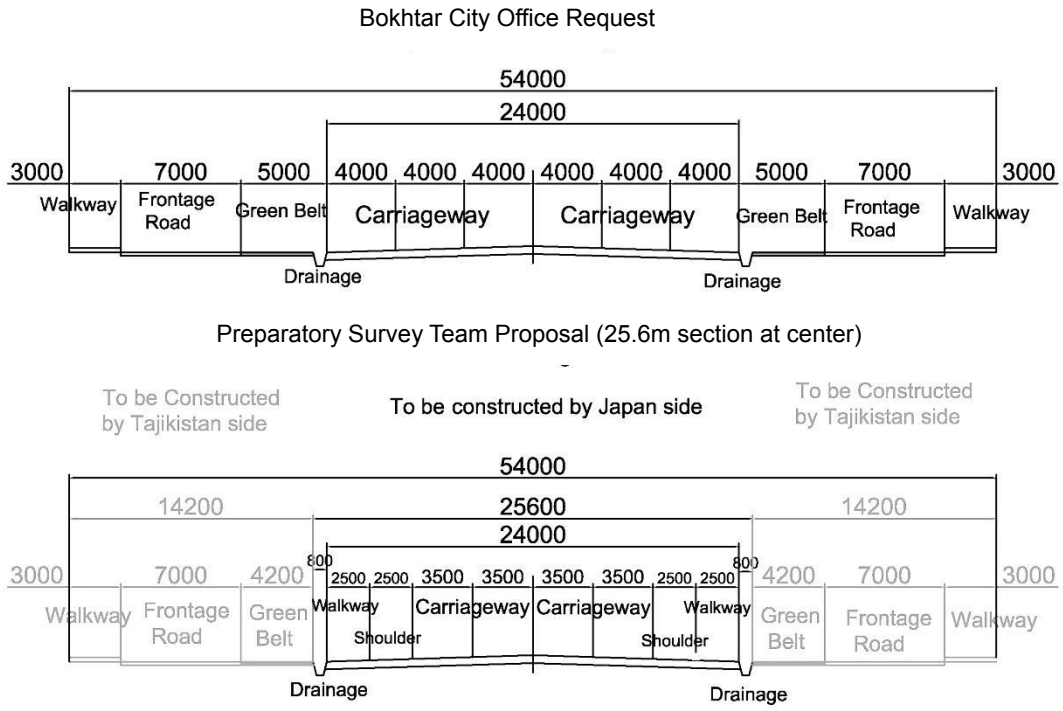


Figure 2.2-4 Proposal by JICA Survey Team

Based on the agreed proposal, structures built by the Japanese side can be converted to 6 lanes in case the development is implemented at the Bokhtar Section.

Following this agreement, MOT and traffic police requested to consider installation of the central median at the road center from the traffic safety point of view. The JICA Survey team carried out a comparative study on the environmental impact based on such modification request as there were many clusters of residential units, hotels and petrol stations along the Project Road. The study concluded to install a reduced width median of 2.0m and reduced shoulder width of 1.75m at both side, finalizing the total road width to be 25.6m and this was accepted by both MOT and Bokhtar City office. Please refer to the 1st T/N.

The content of this study is elaborated in 2.3.2.6.

(3) Agreement Obtained between JICA Survey Team and Bokhtar City Officials

The following is the result of consultation and discussion with Bokhtar City officials.

- The Japanese side will design the road structure at the Bokhtar Section that would be compatible to the 6-lane planned by the Tajikistan side so that the structure is capable for use in case the development is implemented. However, the road would only be constructed as a 4-lane carriageway with the total carriageway width of maximum 24m and the extent of the scope would be limited to the outer end of the drainage by the Japanese side. (The excess width of the road will be used as shoulders (deceleration lane) and sidewalks as a tentative measure.)

- Green belts, frontage roads and sidewalks under the development plan will be under the scope of the Tajikistan side
- Based on the development plan, the new roundabout will be constructed in proximity of the bridge no. 16. This bridge no, 16 will be rehabilitated at the current location under the Project. In case the development is implemented and further improvement is necessary, this shall be carried out by the Tajikistan side.

2.2.1.4 Clarification on Roles and Functions of Project Road

Based on the AH road standard, the Project Road can be classified as Class 1 with the design speed of 100 km/hour and without any walkway. However, the JICA Survey team checked the current and future functions of the Project Road carefully and determined that the Project Road should retain dual roles. The first being the international trunk road designated as AH-7 used by those requiring inter regional movement and the second being the community road for neighboring residents. Especially the Bokhtar Section is a part of Bokhtar city, and the city office has its urban development plan in place.

Based on the above determination, the Preparatory Study team introduced the concept of utilizing both a design speed and a controlled speed limit. Considerably more residents reside along the Project Road compared to other sections of the DB Road, thus more pedestrians. Consultation and discussion took place with traffic police advising the officials that the JICA Survey team intend to install walkways along the entire stretch of the Project Road and to apply the controlled speed limit of 60km/hour which enables placing pedestrian crossings. Traffic police agreed to the proposal. In fact, it is very common in Tajikistan that an international road has the 60km/hour speed limit imposed at urban areas and the 40km speed limit for school and hospital zones. By confirming such practices prevalent in Tajikistan, the JICA Survey team proposed that all intersections, road lightings, and traffic safety facilities would be planned and designed as though the Project Road is a 60km/hour road. (Please refer to the 1st T/N.)

On the other hand, the JICA Survey Team decided to apply the design speed of 100km/hour for the road geometric design so that the Project Road can be serviced at the controlled design speed limit of 100km/hour when the Project Road attains the ultimate AH road standard Class 1 level. The current road alignment is almost straight, and the topographic condition does not pose any serious hindrance. The content of the road alignment study is elaborated in 2.3.2.

2.2.1.5 Project Target Year

The project target year was set at Year 2041 in line with the parameter used by the ADB Project. It is generally said that capturing the trend and changes generated by the local area economy, population and development plans within 20 years are quite a challenge. However, the JICA Survey team felt Year 20 was adequate as the year lies 20 years after the year after the anticipated completion date of the Project. The traffic demand forecast was conducted based on 20years and the details are elaborated in 2.2.6.

2.2.1.6 Extent of Project Scope

(1) Start Point

The extent of the project scope shall be from the end point of phase 2 section of the ADB Section, which is the start point of the Project to the end intersection of the Bokhtar Section, which is the end point of the Project. The end point of phase 2 section of the ADB Section at STA 730+50 was confirmed by the JICA Survey team together with representatives from MOT, ADB and KOCKS Consult GmbH (hereafter referred to as KOCKS), the ADB consultant. The coordinates of the start point and the cross sections are indicated in Table 2.2-1 and Figure 2.2-5.

Table 2.2-1 Start Point Coordinates

Loaction	Coordinates	STA
1 :Left Side Shoulder	X= - 4695.3214, Y=10842.8939	STA 730+50
2: Road Center	X= - 4702.6324, Y=10838.5565	
3: Road Side Shoulder	X= - 4709.9435, Y=10834.2191	

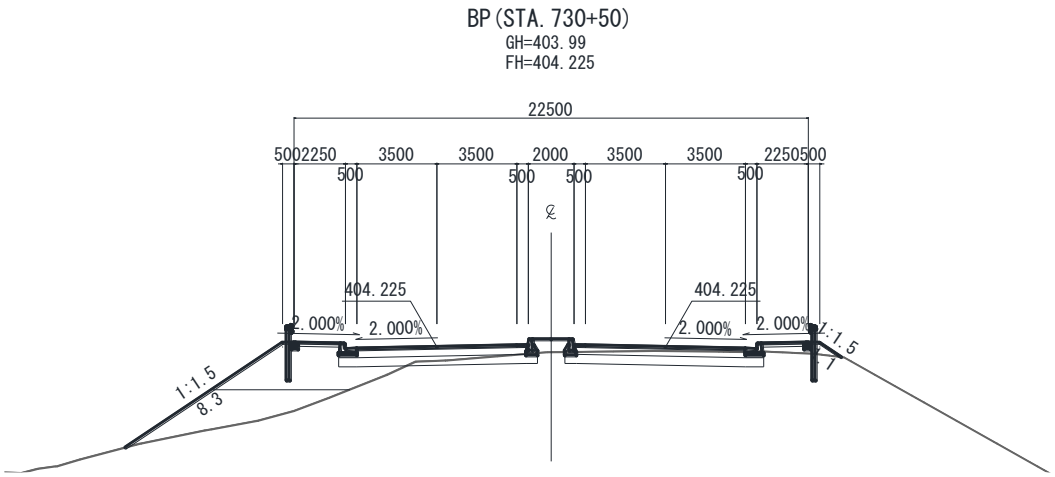


Figure 2.2-5 Start Point Cross Sections

(2) End Point

The end point of the project area was initially expected up to the existing intersection at the entrance of Bokhtar City. However, engineering judgement was made to include the existing small intersection located to the east side, with consideration for traffic safety and traffic congestion mitigation at the end point based on the result of the first site survey, future traffic demand analysis result and discussion with related organization. Then end point was decided as STA. 822+10.799 as shown in Figure 2.2-6.

On the other hand, a part of AH7 in the Dusty direction with improvement of intersection. The content of this study is elaborated in 2.3.3.

Figure 2.2-6 Project End Point

2.2.1.7 Policy of Maintaining Current Road Functions

(1) Accessibility from Other Roads and Considerations Made towards Non-Vehicular Users

The JICA Survey team studied the accessibility from other roads to the Project Road when the 2- lane road is widened to 4-lane as there are always a potential of traffic accidents. The following points were considered.

- Reducing the design speed limit
- Introduction of wider shoulders
- Access via new feeder road
- Consolidation of access points
- Introduction of speed restraint facilities

The JICA Survey team observed that pedestrians and bicycle riders frequently use shoulders. Therefore, a study was made on, in addition to traffic safety facilities for vehicular traffic, sidewalk and pedestrian crossing locations, and traffic safety facilities for non-vehicular users. Considerations for gender equality, school children use and others were made as well. Furthermore, movement of livestock such as cattle, sheep, donkeys etc. on road shoulders was observed as well. The JICA Survey team conducted consultations and discussions with MOT on countermeasures including the method of road crossing by livestock. The details are presented in Section 2.2 and 2.3.

(2) Securing Current Traffic Movement

The study on the optimal locations for establishing median openings and U turns was made. This was required as center medians constructed will prevent traffic movement originally available such as road crossing from the one side of the Project Road to the other and left hand turn from the Project Road to the connecting road on the left side upon completion of the Project. The details are presented in 2.3.4.

(3) Securing All Crossing Drainage Functions

The JICA Survey team confirmed that the existing crossing drainage facilities are dilapidated and full of leakage locations. The team decided to remove the existing facilities and plan, design and replace with the new facilities as road widening will affect all of collection sumps. The details are presented in 2.3.7.

2.2.2 Design Policy

2.2.2.1 Current Situations and Challenges on Project Road

(1) Project Start and End Points

1) Start Point

The Start Point will be the center alignment point from the ADB Section. Owing to existence of transmission towers, the road alignment will be adjusted slightly in order not to interfere with the existing transmission towers. However, this will require removal of a building indicated on the lower right side on the figures. (Please refer to Figure 2.2-7 and Figure 2.2-8.)

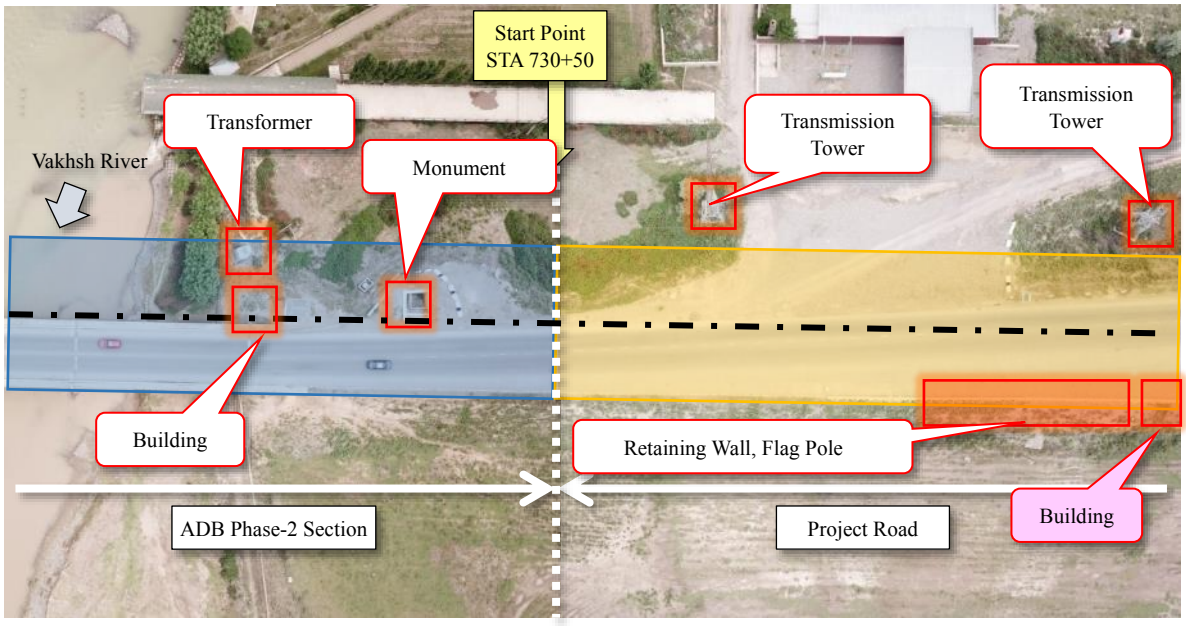


Figure 2.2-7 Start Point and Existing Facilities

Figure 2.2-8 Building Requiring Removal/Relocation

2) End Point

The end of the Project is indicated in Figure 2.2-9 and it is at the existing irregularly shaped 4-sided intersection. This point will be the connecting point between the Project Road under MOT and Bokhtar city office. The existing intersection is serviced as 2 lanes, but the road is sealed from 600m away as a 3-lane width. On the other hand, the road under Bohktar city office is serviced as a 6-lane road and a Chinese contractor carried out the construction work in 2015. There are many petrol stations and hotels along the Project Road. There is a taxi terminal at the intersection and therefore many pedestrians flock the intersection.

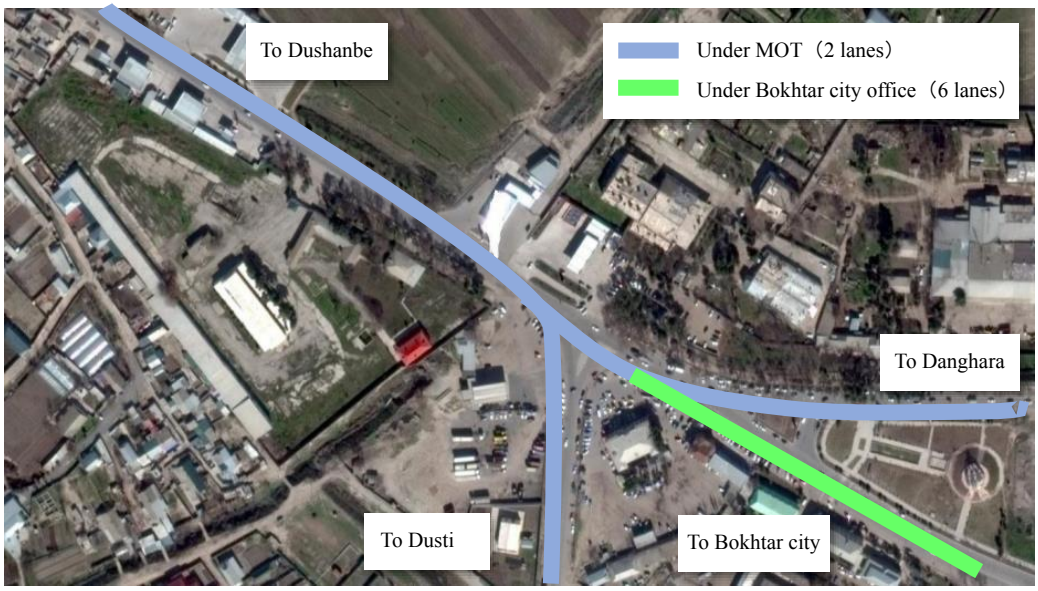


Figure 2.2-9 Existing End Point Intersection

The intersection has no traffic signals and uses plain zebra treatment. The existing traffic use sets the Dushanbe-Bokhtar direction as the main direction and the traffic flow is controlled accordingly. Please refer Figure 2.2-10.

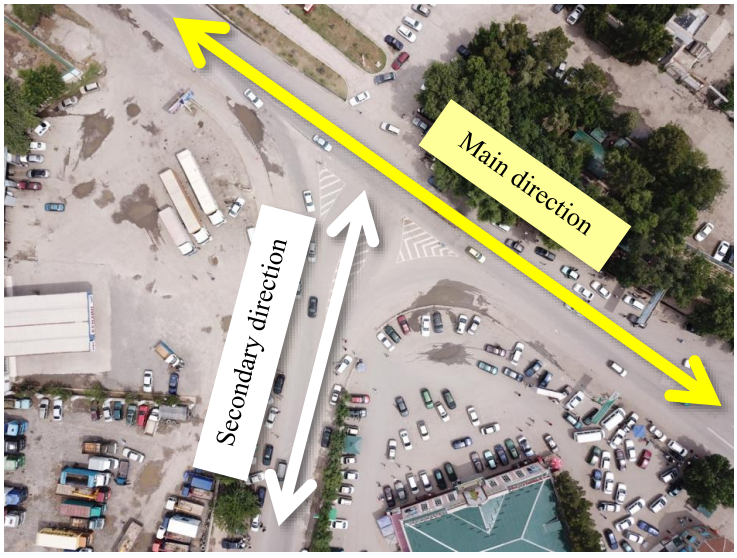


Figure 2.2-10 Existing Traffic Use

(2) Traffic Volume

1) Past Survey Data

A spot traffic survey had been conducted under the JICA Data Collection Survey on a Road between Dushanbe and Bokhtar in the Republic of Tajikistan (hereafter referred to as the Data Collection Survey) in 2015. The traffic volumes in the project area were 13,771-16,571 vehicles/day.

Based on the road classification listed in Japanese Road Structure Ordinance using road widths and running speeds, the Project Road is equivalent to a Japanese Type 3 Class 1 road. Based on such classification, the traffic capacity per lane is 11,000 vehicles/day and 22,000 vehicles/day for the 2-lane road. If comparison is made between the traffic volumes obtained in 2015 with this 22,000 vehicles/day, it is identified that the traffic capacity has not be saturated.

2) Survey Result Undertaken under Preparatory Survey

In order to verify the past survey data, the JICA Survey team conducted a 24-hour traffic volume survey at the mid point of the Project Road. The traffic volume obtained was 15,560 vehicles/day and a nominal increase in volume compared to the 2015 data. The peak hours were from 4PM to 6PM in the evening and the commercial vehicles ratio was 8% as indicated in Figure 2.2-11.

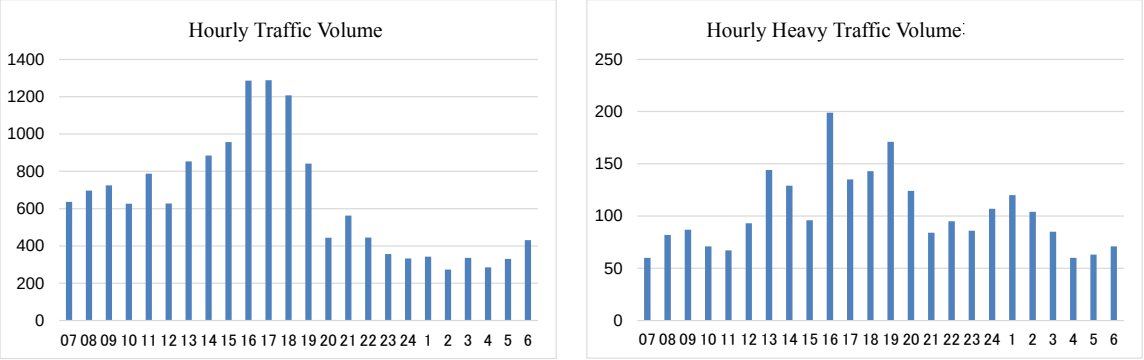


Figure 2.2-11 Hourly Daily Traffic Volume and Commercial Vehicles Ratio (May 2018)

(3) Road Structure and Land Use Situation

The Project Road currently retains a nearly straight horizontal alignment and less than 2% vertical alignment grade. The road is a 2-lane road and either on embankment or on ground as indicated in Photo 2.2-1. The right of way (hereafter referred to as the ROW) as stipulated under the Tajikistan laws and regulations is 25 m both sides from the road center, which means 50m width. However, within this ROW, there are scatterings of residential units, commercial facilities, graveyards and others. On both sides of the Project Road, strips of agricultural farmland exist and 8 nos. of irrigational channels as well as 8 nos. of drainage facilities such as bridges and box culverts cross the Project Road as indicated in Photo. There is only one intersection with traffic signal system. Electricity poles, suspended transformers and underground utility lines exist on and under the land outside road shoulders as indicated in Photo and this plot of land is also used as walkways.

Photo 2.2-1 Existing Road Condition

Photo 2.2-2 Existing Bridge

Photo 2.2-3 Markers for Underground Utilities

(4) Pavement Situation

Under the Project for Improvement of Road Maintenance, a JICA technical cooperation project implemented from 2013 to 2016, measurement of International Roughness Index (hereafter referred to as IRI) was carried out to evaluate the road roughness. The Project Road had been covered and the average IRI value ranged from 3 to 7. From this result, it can be determined that a vehicle is able to drive at 60km/hour and under relatively high drivability. On the other hand, site observations confirmed numerous localized alligator cracks as indicated in Photo 2.2-4 as well as many potholes in Photo 2.2-5. In addition, there were observations of serious pavement damage caused by water leakage from the crossing irrigation and drainage channels (Photo 2.2-6).

Photo 2.2-4 Localized Alligator Crack

Photo 2.2-5 Potholes

Photo 2.2-6 Water Leakage

(5) Review on Outline Design under Ongoing ADB Project

Previously the Project Road was a part of the scope under the ADB Section and the outline design under ADB (hereafter the ADB Design) had been completed. As such, residents' meetings had been conducted based on the ADB Design as well. The scope of ADB Section phase 2 was reduced as the Project Road became the scope to be surveyed under Japanese grant aid assistance.

In order to understand the design philosophy of the ADB Project and to ensure maintaining design parameter consistency between the Project and the ADB Project, the review of ADB documents was conducted.

1) Road Width

The standard cross section at STA730+50 is indicated in Figure 2.2-5. This is at the start point of the Project. The JICA Survey team observed that the 3.5 m carriageway width and the 3.0 m median width were called for in the ADB Design in compliance with the AH Standard design speed of 80-100km/hour. Although installation of sidewalk was never called for under ADB road classification Class 1, 2.25 m sidewalk width was planned in ADB Design. On the other hand, inner shoulder 0.50m and protective shoulder .05 m instead of the standard shoulder width of 3.00 m were set.

However, assumed that sidewalk is a part of shoulder, it is satisfactory for the standard shoulder width of 3.00 m. The JICA Survey team also confirmed that special considerations were made within built up areas of the ADB Section on allowing installation of sidewalks over road shoulders applying the practice under SNiP although this was never called for under ADB road classification Class 1. The walkway width was designed by allowing passage of 3 pedestrians (0.75m x3).

2) Road Alignment

The review on the road alignment revealed the following;

a) Horizontal Alignment

- ✓ A curve of R=10,000 is introduced at STA735+40～STA740+40 section. Other than this, the curve is introduced, and the alignment is bent.
- ✓ There are sections which do not have the required shift length.
- ✓ The existing road width is adopted for the Bokhtar Section.
- ✓ In principle, the alignment follows the alignment of the existing road.

b) Existing Features Affecting Alignment (Control Points)

- ✓ The control points adopted under the ADB Design are as follows;
  - ① STA791-795(R)： Existing graveyard
  - ② STA.806-EP(L)： Existing buildings (residential, petrol stations and others)

c) Vertical Alignment

- ✓ The ramp gradient of the bridge on Vakhsh River is set as I=0.030%.
- ✓ I max=1.135% (Nearby STA.770) and I min=0.002% (STA.814-817). The section under I min does not have sufficient drain slope, which is I min=0.3%.
- ✓ In principle, the alignment calls for slight fill over the existing formation level.

d) Others

- ✓ U-turn sections are introduced.
- ✓ Access onto residential and commercial plots is considered for.

The review of the ADB Design revealed that full efforts were made to fit the alignment within the existing situation, thus minimizing the project impact by allowing the horizontal alignment of the existing road to full extent and raising the vertical alignment higher.

Based on the above review, the JICA Survey team confirmed that the road alignment policy of the ADB Design matched the same of the Project.

3) Pavement

The pavement design under the ADB Design called for the asphaltic surfacing to withstand 10 years and basecourses to withstand 20 years. Under the customary national highway development practice in Japan, pavement design for new construction called for 20 years as performance period. As such, the JICA Survey team adopted 15 years from the budgetary aspect. The concept of splitting to asphaltic surfacing and basecourses is not to be adopted.

2.2.2.2 Policies on Site Investigation and Surveys Undertaken

In order to attain the level of accuracy required for planning/design, construction planning and cost estimation elements of preparatory surveys, site investigation and surveys were conducted. Items, objectives locations and methods of investigation are summarized in Table 2.2-2.

Table 2.2-2 Site Investigation and Surveys

Name	Objectives	Locations	Investigated Items	Methods
1. Meteorological Survey	To understand meteorological conditions required for planning, design and construction of the Project	Project Road and Its Vicinity	• Temperature, Precipitation and Annual Precipitation Pattern	Collecting existing data, analysis, interviews and visual confirmation
2. Topographic Survey	To understand topographical conditions required for planning, design and construction of the Project	Project Road and Its Vicinity	• Verification of topographical map prepared under ADB • Topographic survey • Cross sectional survey • Setting up temporary project benchmarks	Use of Sub-Consultant
3. Geotechnical Survey	To understand geological conditions required for planning, design and construction of the Project	Project Road/Its Vicinity and Material Production Location	• Field survey • Bore logs and SPT • Boreholes for underground water table monitoring • Trial pit test and CBR test • Dynamic cone penetration test • Material specification test (embankment, basecourses, asphaltic concrete aggregates and ready mixed concrete aggregates)	Use of Sub-Consultant

Name	Objectives	Locations	Investigated Items	Methods
4. Underground Water Table Survey	To understand underground water table conditions required for planning, design and construction of the Project	Project Road and Its Vicinity	• Monthly underground water table monitoring	Use of Sub-Consultant
5 Utilities Inventory Survey	To understand underground utility conditions required for planning, design and construction of the Project	Project Road and Its Vicinity	• Underground utilities at intersections and its vicinity • Simplified method	Collecting existing data, analysis, interviews and visual confirmation
6. Traffic Volume Survey	To obtain the present traffic volume for assessing the future traffic demand	Project Road/Its Vicinity and Intersections	• 24-hour traffic volume • Intersection traffic volume at peak hours in various directions • Origin and destination survey	Use of Sub-Consultant
7. Drainage Condition Survey	To understand drainage system and outflow conditions required for planning, design and construction of the Project	Project Road and Its Vicinity	• Direction of discharge • Size and shapes of facilities • Outflow locations	Collecting existing data, analysis, interviews and visual confirmation
8.Miscellaneous Site Information Survey	To collect site information necessary for design	Intersections and Its Vicinity	• Aerial photography using drones • Existing road pavement condition • Traffic flow at intersections and its vicinity • Nos. of pedestrians • Existing road surfacing condition • Land use situation • Population and social affairs • Economy and industries	Field survey by JICA Survey team, collection of existing data/analysis

2.2.2.3 Policies on Socio-Economic Conditions

(1) Project Site Conditions

1) Land Use Situations along the Project Road

Figure 2.2-12 to Figure 2.2-14 illustrate the land used along the Project Road. The Project Road can be classified into the general section where both sides of the road are covered with agricultural farmland and the Bokhtar Section where clusters of hotels, commercial facilities and petrol stations line alongside the road.

In the general section, built up areas are situated away from the Project Road and the impact of road widening is considered small. On the other hand, many facilities are built along the Project Road at the Bokhtar Section with frequent vehicular access from adjacent roads and many pedestrians walking along the road.

Figure 2.2-12 Land Use Situation (1/3)

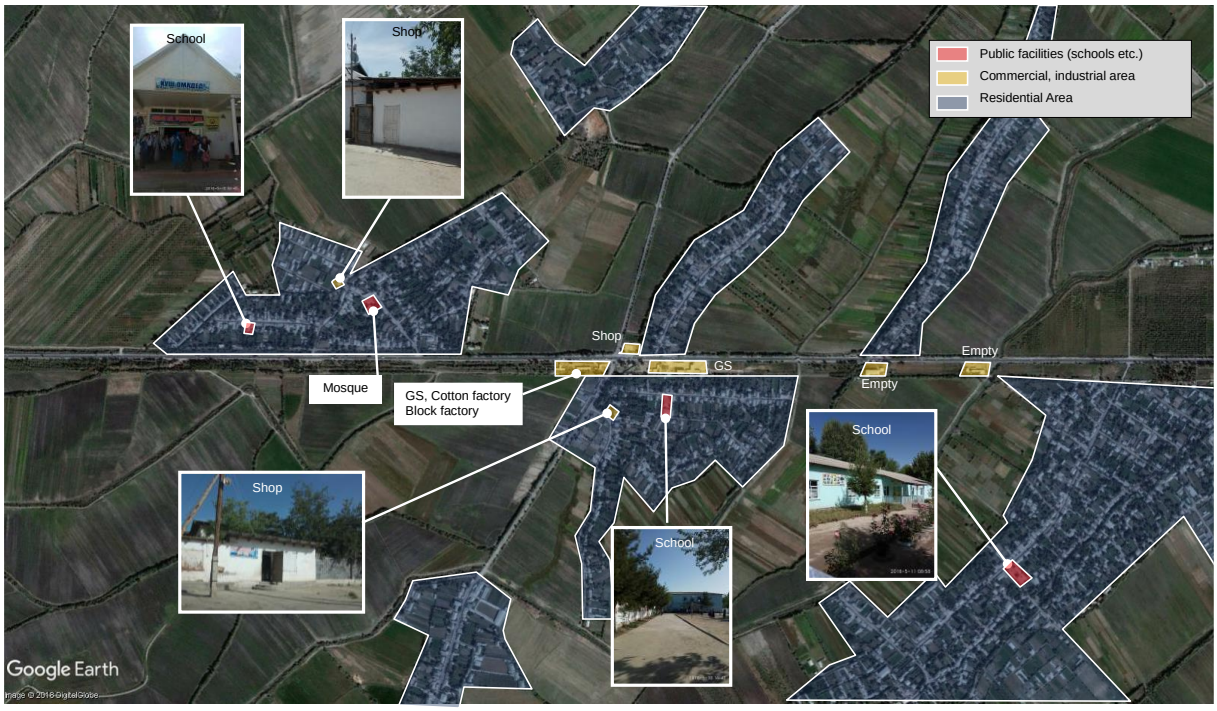


Figure 2.2-13 Land Use Situation (2/3)

Figure 2.2-14 Land Use Situation (3/3)

2) Industrial and Economic Situations at Project Site

The Project Road is situated in Kushoniyon region and Bokhtar city. The population of these areas is as indicated in Table 2.2-3 with 23,189 registered in Kushoniyon region and 111,049 registered in Bokhtar city.

The main industries of the project site are agriculture and livestock farming. Cotton, wheat and fruits are produced.

Table 2.2-3 Project Site Population

Region/City	Total Population	Male Population	Female Population
Kushoniyon Region	231,893	116,640	115,253
Bokhtar City	111,049	55,637	55,412

2.2.2.4 Policies on Procurement Conditions related to Construction Works

(1) Labor Procurement Policy

1) Labor Procurement Situation

Based on the investigation, the JICA Survey team obtained information on the following labor procurement situation in Tajikistan.

- There are a few private firms with experience of many completed construction projects. Based on such information the JICA Survey team judged that labor required for construction can be procured locally.

- Such workers as foremen for both civil engineering works and bridge construction works, specialists for bridge construction, skilled workers, riggers, welders, rebar workers, formwork carpenters and heavy machinery operators can be either sourced from nearby the site area, from Dushanbe or from Khujand.
- Workers of job classifications not listed above are available from Bokhtar region.

2) Applicable Labor Laws and Regulations

Tajikistan labor laws stipulate the following;

a) Basic Working Hours：

Basic working hours are 8 hours a day from Monday to Friday and the weekly working hours must be equal or less than 40 hours. Generally, the practice is from 8 AM to 17 PM.

b) Overtime：

In case workers performed overtime on weekdays or a work on non-week days, workers will be compensated with various allowances.

c) Custodial Measures on Remuneration to Workers：

Custodial measures are clearly stipulated under the Tajikistan law that remuneration to workers has the highest preference over other liabilities, which it shall not be influenced by events of tender, bankruptcy or accession and that payment for remuneration shall be made immediately.

d) 13 Months Pay：

Upon successful completion of 1 year (12 months) of continued work, the worker is entitled to receive payment of additional 1-month remuneration. In case the worker completes working for more than 1 month, but less than 1 year, he is entitled to receive payment equivalent to the period that he worked as stipulated in the employment agreement.

e) Termination Money：

The employer is obliged to pay termination money equivalent to the monthly remuneration in case he terminates the worker who has worked continuously for 1 year.

f) Labor Procurement Policy

Based on the findings made by the JICA Survey Team as presented above, local contractors are available to participate in the Project with ability to provide skilled workers and technicians as a sub-contractor under the umbrella of a main contractor registered in Japan. Upon further scrutiny of human resources available and past performance, use of local contractors shall be promoted.

(2) Construction Materials Procurement Policy

The JICA Survey team confirmed that major materials could be procured either locally or through importation, excepting additives for modified asphalt which required importation from Japan. As such, major materials shall be procured either from Dushanbe or from neighboring countries such as Iran, Russia etc.

(3) Construction Plants and Equipment Procurement Policy

The JICA Survey team confirmed the majority of construction plants and equipment required for the Project were available from local contractors. In addition, general machineries such as back-hoe excavators and bulldozers can be leased locally. Cranes are also locally available unless the lifting capacity required is extraordinary big. As such, construction plants and equipment shall be procured locally.

(4) Policy on Construction of Irrigation and Drainage Channel

The Ministry of Melioration and Irrigation is in charge of maintenance and management of the irrigation channel and sluice gate.

In the target area of this project, March to October is the period of agriculture, and water supply is necessary in this term. However, if applying to the provincial government and the Ministry of Melioration and Irrigation, it is possible to stop the water flow for about two days (the residents are occasionally stopping the water to clean the canal). November to February is agricultural off-season, and agriculture is not carried out. If applying to the provincial government and the Ministry of Melioration and Irrigation, it is possible to stop the water flow during this term (November 1 - March 1) (In the hearing to the residents, it was said that the water was stopped from January to February in 2018). At the time of application, application will proceed smoothly when official letter is submitted from MOT. Also, in meeting about application for suspension of water flow, it is advisable to include the agricultural cooperative (JAMOAT) which is replacement of Kolkhoz and Sovkhoz.

The operation of the flood gate for stopping the irrigation water in the design section is based on the adjustment at the dam 46 (the water gate at the diversion near the airport: see Figure 2.2-15). At this time, the excess water is discharged to other irrigation waterways heading south (outside the design section). If it is necessary to shut down all the water at the same time due to construction work, it is necessary to consult and adjust with the dam manager in Sarband Dam at the upper stream of Vakhsh river which is a source of irrigation water. In addition, there are two water gates downstream of the dam 46 that can adjust the irrigation flow. The condition of the dam / hydrological facilities are shown in Figure 2.2-16.

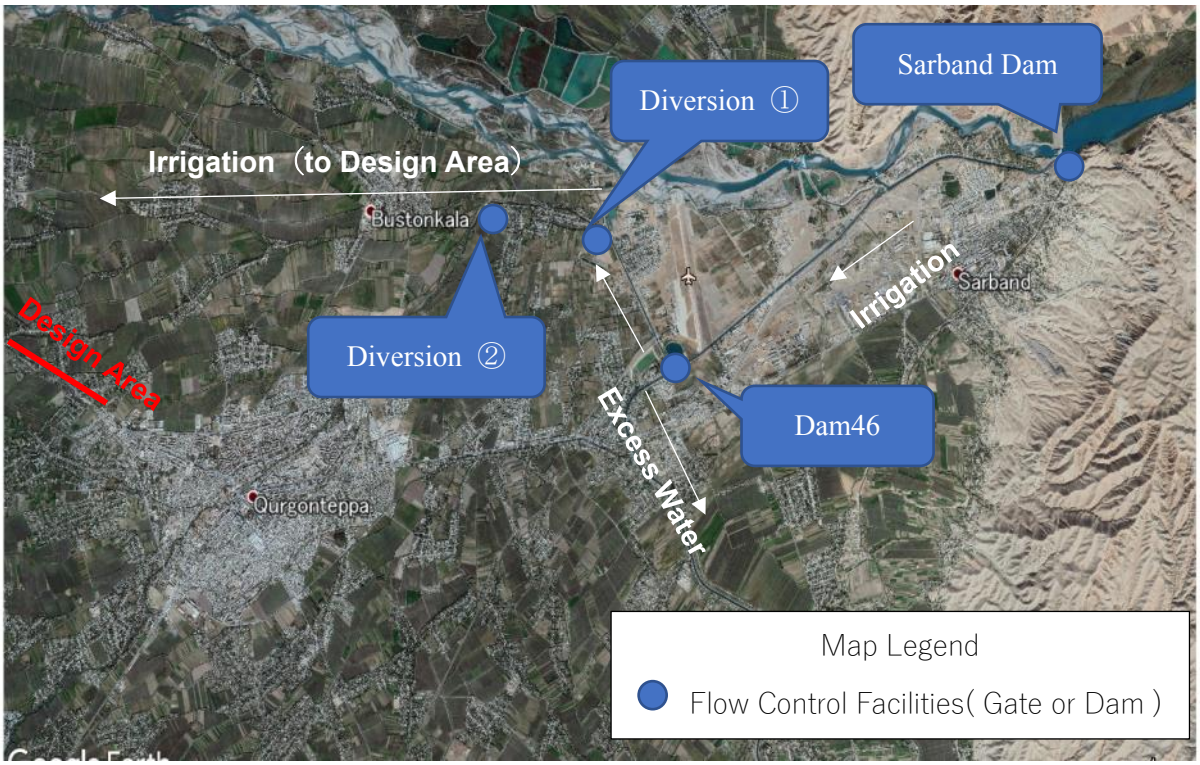


Figure 2.2-15 Location of Dam 46 and Sarband Dam

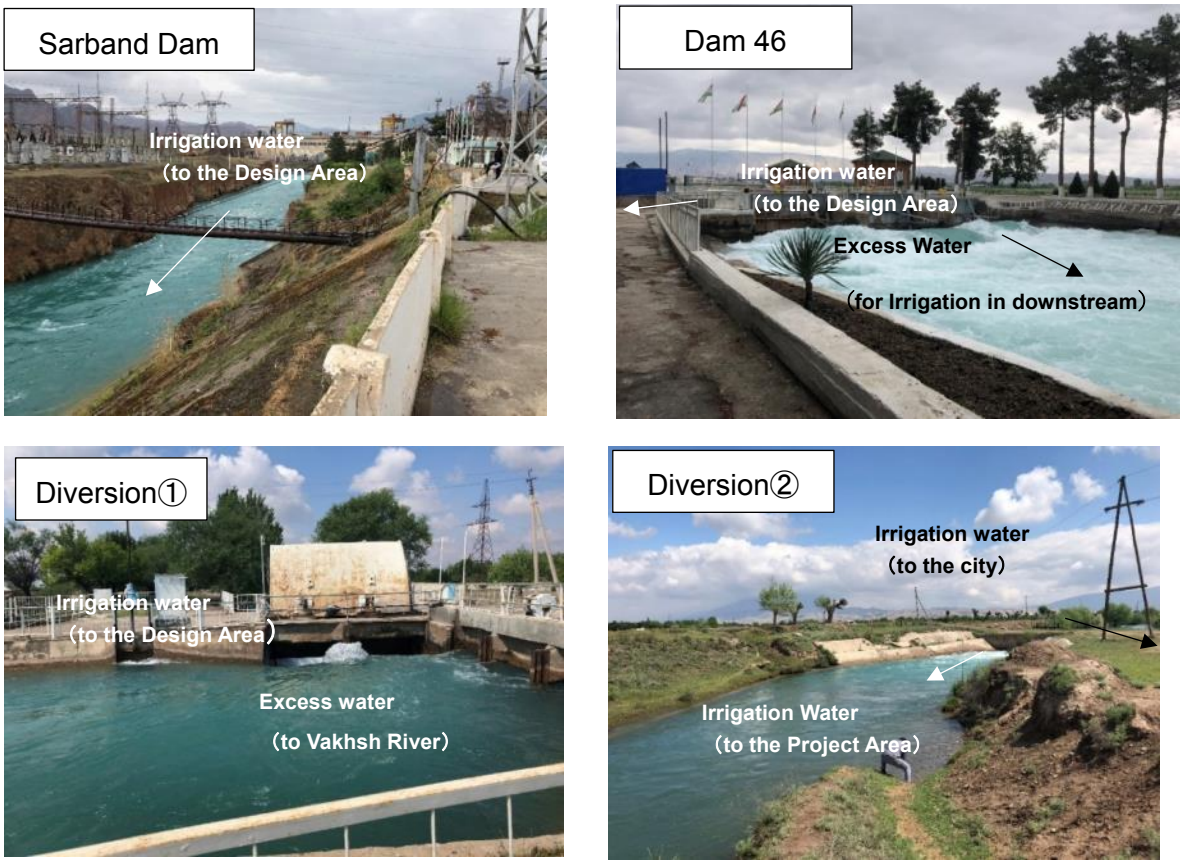


Figure 2.2-16 Dam and Gate Condition

2.2.2.5 Policies on Road Rehabilitation

(1) Basic Concept

The basic concept for road rehabilitation is set as per below.

(a) Planning for road widening shall consider impact mitigation on environment, project cost reduction and implementation acceleration.

(b) The widths of road shoulders shall consider for slow moving objects such as livestock, farming tractors, etc.

(c) Installation of sidewalks and road crossings to ensure pedestrian safety.

(d) Installation of traffic safety facilities including consideration for night time users.

(e) Planning to ensure existing road functions such as securing all drainage crossings and existing traffic movement.

(f) Planning for road drainage facilities with considerations on natural conditions such as precipitation, underground water and topographic features.

(g) Road planning in line with the existing Tajikistan development plan.

(h) Intersection improvement with consideration for future traffic demand.

(2) Policies on Road Widening

The direction of road widening is set based on the following conditions. The list indicating the direction and applicable sections are in Table 2.2-4.

- Condition -1: Securing traffic safety against the design speed
- Condition -2: Minimize impacts as much as possible on residential units and facilities alongside the Project Road
- Condition -3: Ensure safety of existing traffic during the construction stage
- Condition -4: Comply with all the above conditions and minimize the construction cost

Table 2.2-4 List of Road Widening Direction

Section	Length(m)	Directions (Left, Right, Both)	Existing Features Affecting Alignment (Control Points)
STR.730+50 - STA.733+00	250	Left Side	Existing Retaining Wall on the Right Side
STA.733+00 - STA.744+00	1100	Both Sides	
STA.744+00 - STA.770+00	2600	Right Side	Major Drainage Channel
STA.770+00 - STA.790+00	2000	Both Sides	
STA.790+00 - STA.796+00	600	Left Side	Graveyard
STA.796+00 - STA.806+00	1000	Both Sides	
STA.806+00 - STA.822+00	1600	Left Side	Buildings on the right side

(3) Standards for Road Design and Design Speed Adopted

Comparison is made among the AH road standard, the Russian standard used in Tajikistan (hereafter referred to as the SNiP) and the design standard under the Japanese Road Structure Ordinance. It is listed in Table 2.2-5. Considering importance of road continuation of the DB Road and maintaining design parameter consistency between the Project and the ADB Project, the AH road standard Class I is adopted for the Project.

Table 2.2-5 Comparison Table on Road Design Parameters

Design Parameters		4-Lane Road			
		AH Road Standard (Class I)	SNiP (Class I-a)	SNiP (Class I-b)	Japanese Road Structure Ordinance (Type 3 Class 1)
Design Speed (km/hr.)	Flat	100	150	120	80
	Hilly	80	120	100	-
	Mountainous	50	80	60	60
Carriageway Width (m)		3.50	3.75	3.75	3.50
Road Shoulder Width (m)		3.00	3.75	3.75	1.25
Median (m)		3.00	6.00	6.00	1.75
Minimum Curve Radius (m)	Flat	350	1,200	800	280
	Hilly	210	1,000	600	-
	Mountainous	80	300	150	150
Maximum Gradient (%)	Flat	4	3.5	3.5	4
	Hilly	5	3.5	3.5	-
	Mountainous	6~7	4	4	5
Road Width (m)		40	100 (50)	100 (50)	-

(4) Other Standards to be Conformed with

SNiP and GOST Standard are the standardized technical documents for road design in Tajikistan. In the Project, the AH road standard shall be the governing standard and in case supplementary standards are required, such shall be referred from the design standard under the Japanese Road Structure Ordinance, AASHTO standard and the above mentioned standardized technical documents for road design in Tajikistan. The list of conforming standards is as in Table 2.2-6.

Table 2.2-6 List of Conforming Standards

Items	Conforming Standards	Contents
Road and Ancillary Facilities	● AH road standard ● SNiP ● Japanese Road Structure Ordinance	● Design Speed: 100km/h ● Geometric design under AH road standard. For design parameters unavailable under AH road standard, either SNiP or Japanese Road Structure Ordinance adopted.
Pavement	● AASHTO	● Performance Period：15years（2022～2037） ● Use of modified asphalt under study
Intersections and Traffic Safety Facilities	● Highway Capacity Manual ● SNiP ● Japanese Road Structure Ordinance	● Traffic capacity at intersection conducted ● Details conform to Tajikistan standard drawings
Structures	● SNiP (For live load only. Adoption of the same value for the ADB Project） ● Culvert Structure Guideline, Japan	● Live load: 245KN/axle loading（SNiP） ※25% over T load ● Design horizontal seismic coefficient: 0.2
Drainage	● SNiP（Rainfall intensity only） ● Drainage Guideline, Japan	● Rational method for discharge volume calculation ● Box culverts: 1/50 year probability ● Other drainage facilities: 1/10year probability
Street Light	● Street Light Installation Standard, MLIT, Japan ● LED Installation Guideline, Japan	● LED lighting adopted

2.2.2.6 Policies on Traffic Demand Forecast

(1) Basic Concept

The designed traffic volume is determined using year 2041 as the project target year, the same year adopted by the ADB Project.

(2) Traffic Survey Result

1) 24 Hour Traffic Count Result on Roadway Section

15,560 vehicles/day, being the result presented in 2.2.2.1 is used for determining the future traffic demand.

2) Peak Hour Traffic Count Result based on Traffic Directions on Intersection Section

a) Scope of Traffic Count

The inflow traffic at the intersection is shown in Figure 2.2-17. Since, the smaller intersection, which is considered as the end of the Project, and the major intersection 200 m away from the end point are of proximity to each other, the peak hour traffic count is conducted together.

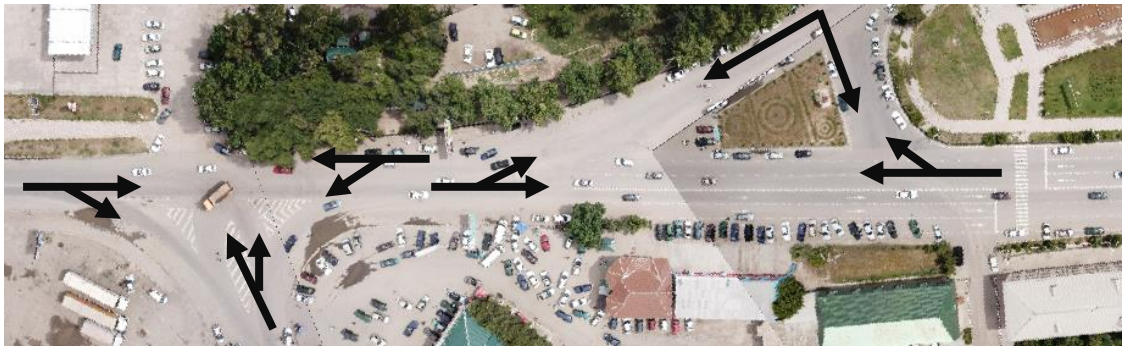


Figure 2.2-17 Inflow Traffic Volume eat Intersection

b) Survey Results

The result of the peak hour traffic count is indicated in Figure 2.2-18.

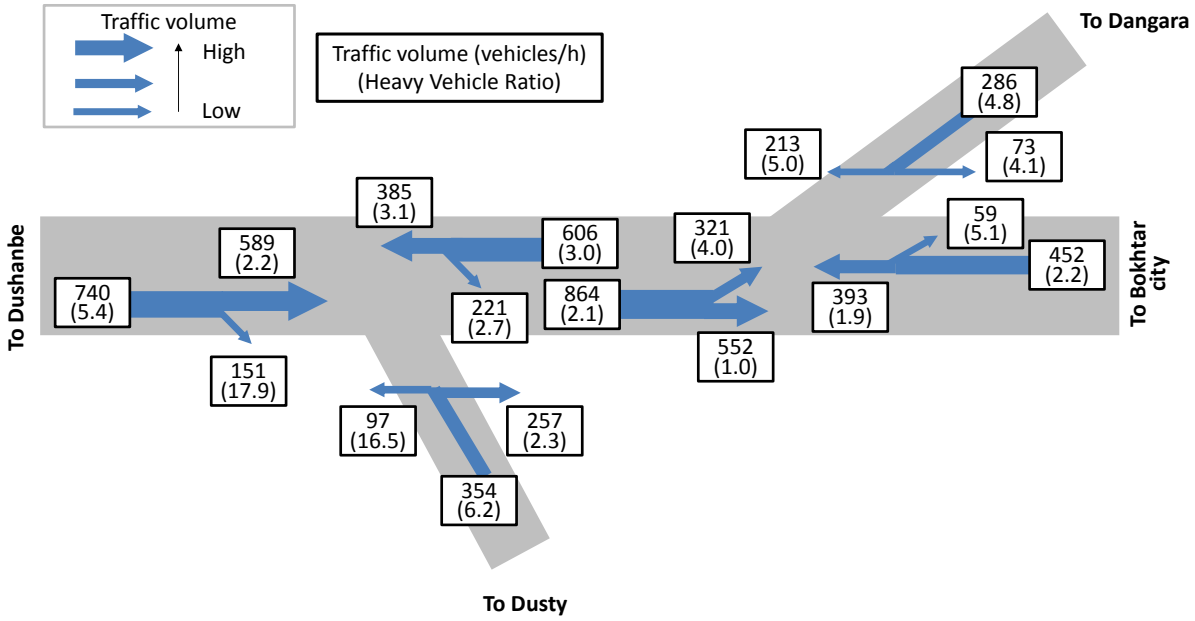


Figure 2.2-18 Peak Hour Traffic Count Result

3) Origin and Destination Survey Result

a) Survey Location

Figure 2.2-19 shows OD survey locations. 500 samples at each inflow lane were collected.

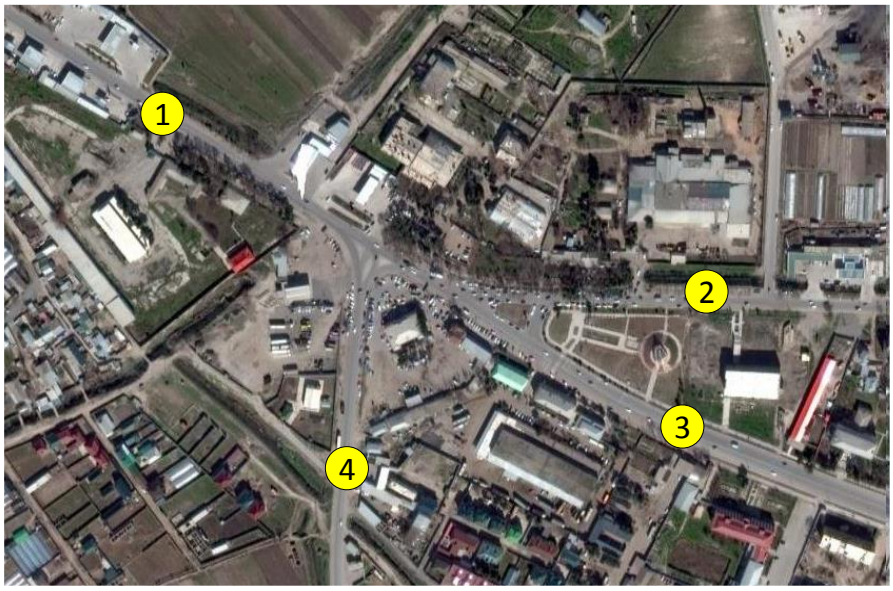


Figure 2.2-19 Survey Location

b) Analysis Result

After analysis of OD survey result, following points are clarified.

- An OD pair between Bokhtar and Dushanbe accounts for 50% of all pairs, and 70% of it is composed of passenger car and taxi.
- Interzonal traffic having a pair within Bokhtar area accounts for 9%. It means that through traffic is major at this intersection.
- Average trip length of trailers is approximately 190 km, and the other type of vehicles is approximately 60 km to 90 km.
- 50% of heavy vehicles has a pair between Bokhtar and Dushanbe, or Bokhtar to Huroson.
- Trip length between Dushanbe and Afghanistan of trailers is longer that the others.

c) Observation

Since through traffic is major in this intersection, interzonal traffic has little influence on the future traffic volume calculation. The OD result shall be used for estimation of project outcome.

4) Traffic Queue Length Survey

a) Survey Location

It was conducted at the same location as OD survey.

b) Analysis

After analysis of traffic queue length survey result, following points are clarified.

- Approximately 50m queue length during morning and evening peak hour (7am to 10am and 4pm to 7pm) was chronically confirmed only at the inflow lane in the Dusti direction
- 90m queue length was maximum and occurred during 8:45 to 10:00
- A tendency that vehicle from Dusti is forced to be stored since Dusti side is secondary road when they enter to the Dushanbe – Bokhtar main direction can be seen.

c) Observation

With increase of traffic volume in the future, signalized intersection would be preferable for safety traffic operation.

(3) Traffic Demand Forecast Calculation

1) Roadway Section

a) Calculation Conditions

The traffic demand forecast was conducted with the following conditions and assumptions.

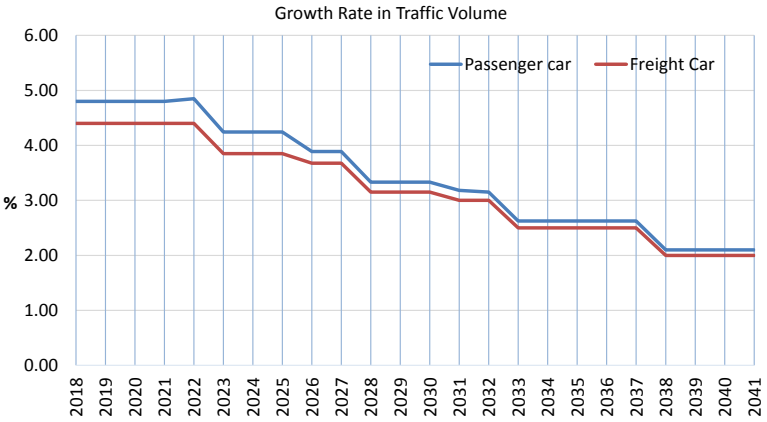
- For the forecasting, the base data will be the future GDP forecast data compiled by IMF by applying elasticity factor (passenger car: 1.2 and freight car: 1.1) in accordance with calculation methodology in ADB section.
- The assumption is made that a new traffic demand will be generated due to the reduction of traffic cost based on the road improvement. Therefore, for the first 10 years upon road commissioning, the assumption is made that the traffic demand will increase by approximately 1% every year.
- The assumption is made that the future GDP growth will be slower for 5 years from 2023 by approximately 0.5% every year from the future GDP forecast data compiled by IMF.

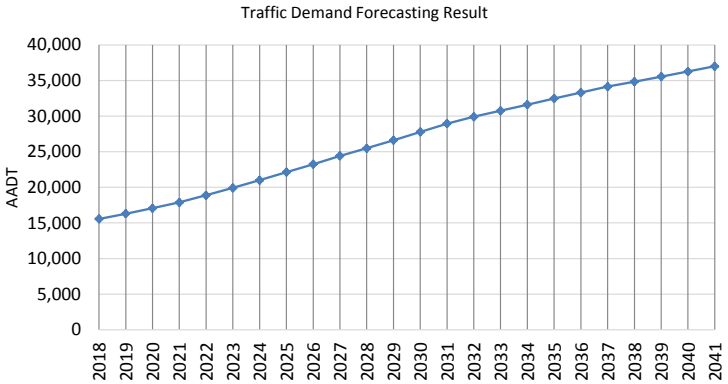
b) Calculation Results

The result of calculation is indicated in Table 2.2-7. The result indicates that the traffic demand forecast for the year 2041 will be approximately 2.4 times larger than the present traffic volume surveyed in 2018.

Table 2.2-7 Traffic Volume Increase Forecast in % and Future Traffic Demand Forecast

Year	Increase Forecasted in %		Traffic Volume
	Private Vehicles	Commercial Vehicles	
2018	4.80	4.4	15,560
2019	4.80	4.4	16,297
2020	4.80	4.4	17,069
2021	4.80	4.4	17,877
2022	4.85	4.4	18,882
2023	4.24	4.4	20,018
2024	4.24	3.85	21,096
2025	4.24	3.85	22,224
2026	3.89	3.675	23,334
2027	3.89	3.675	24,493
2028	3.33	3.15	25,571
2029	3.33	3.15	26,691
2030	3.33	3.15	27,855
2031	3.18	3	29,023
2032	3.15	3	29,985
2033	2.63	2.5	30,823
2034	2.63	2.5	31,680
2035	2.63	2.5	32,558
2036	2.63	2.5	33,381
2037	2.63	2.5	34,226
2038	2.10	2	34,919
2039	2.10	2	35,627
2040	2.10	2	36,350
2041	2.10	2	37,088





2) Intersection based on Traffic Directions

a) Calculation Conditions

The traffic demand forecast at the intersection was conducted with the following conditions.

- The result of 24-hour traffic count was assumed as the inflow traffic volume from Dushanbe to Bokhtar direction. Then utilizing the result of the peak hour traffic count for all traffic directions, the inflow and outgoing traffic volumes of all traffic directions were proportioned.
- The same conditions and assumptions made for the roadway section were applied for the intersection traffic demand forecast.

b) Calculation Results

The result of calculation is indicated in Figure 2.2-20.

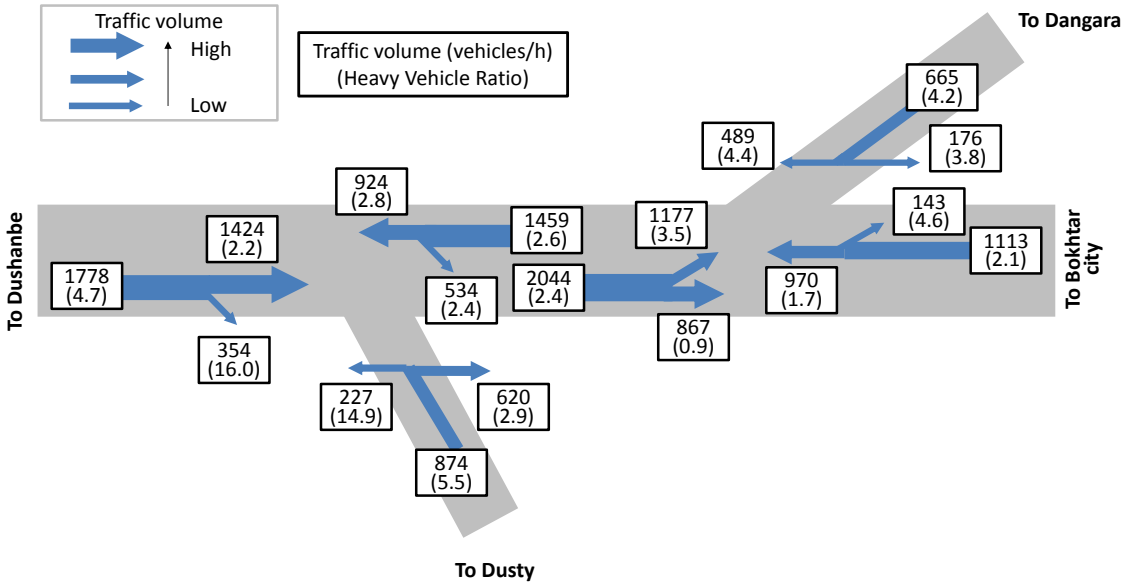
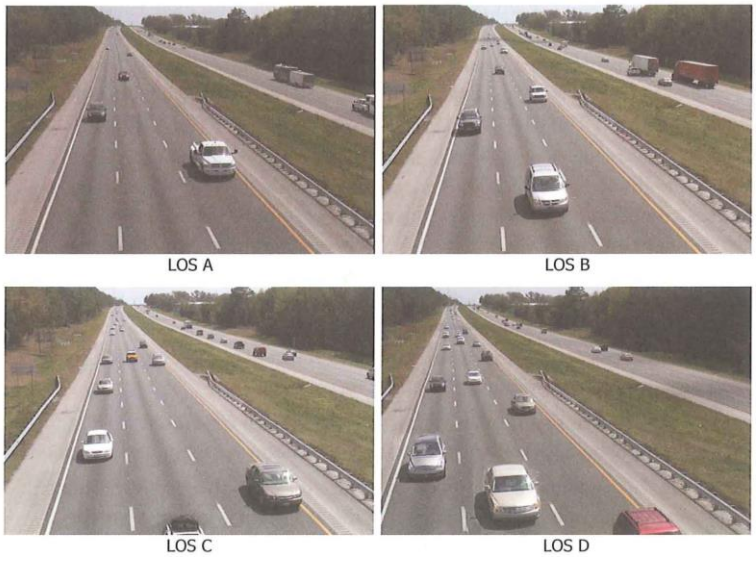


Figure 2.2-20 Peak Hour Traffic Demand Forecast at the Intersection Classified by Directions

(4) Required Traffic Lanes during Peak Hours

Additional check was conducted to verify whether the existing 2 lane road would be adequate from the road capacity point of view in the project target year of 2041. For this verification, methodologies recommended in the Highway Capacity Manual 2010 by comparing the peak hour traffic demand was used. The verification used the case when no rehabilitation would be made on the Project Road, but increase made on the traffic volume. For evaluation purpose, the Level of Service (hereafter referred to as the LOS), an indicator for the traffic density of the road and the typical method for such verification, was used as indicated in Figure 2.2-21.



From: Highway Capacity Manual 2010

Figure 2.2-21 Image of LOS from LOS A to LOS D

The JICA Survey team judged that it would be over excessive to maintain the Project Road at the LOS C level at the project target year of 2041 as it would be non-feasible. Also, by considering that the

projected completion of the Bokhtar City Urban Development was set at year 2035, the LOS D level would be adequate for the evaluation threshold. The result of verification is indicated in Figure. Based on the result, the JICA Survey team confirmed that the Project Road falls under the LOS D level currently, but would attain the LOS E level from year 2023 onward. This would imply that chronic congestion would occur on the Project Road from 2023. As such, it is determined that the Project Road should be improved as a 4-lane road before 2023.

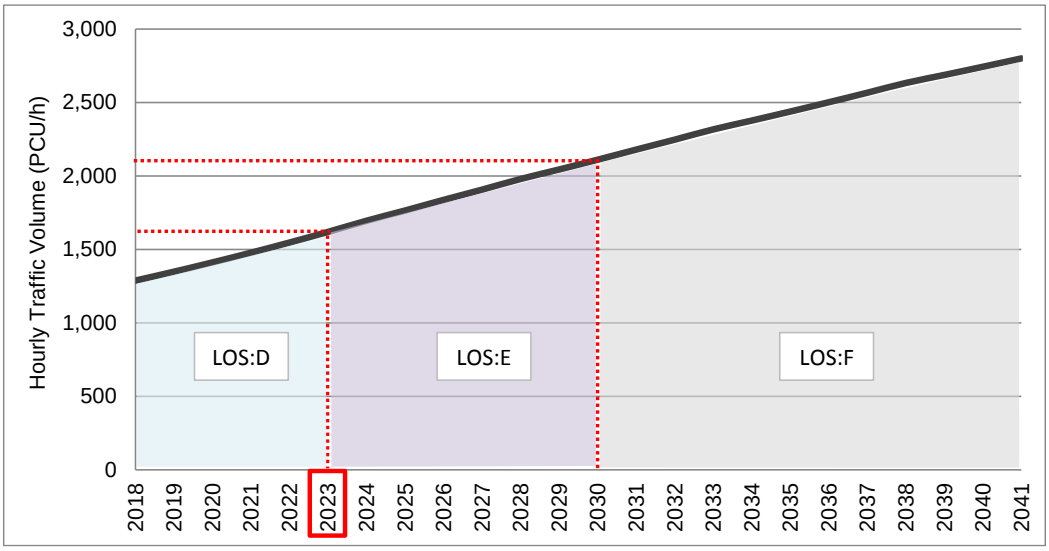


Figure 2.2-22 Anticipated LOS

2.2.3 Basic Plan

2.2.3.1 Project Outline

(1) Contents of the Project

Table 2.2-8 shows contents of the project.

Table 2.2-8 Contents of the Project

Type	Item		Quantity	Remarks
Road	Objective Length		9.2 km	● Start Point : End point of ADB Phase2 section (STA.730+50) ● End point : STA.822+10.799
	Number of Lanes		4-lane	● Carriageway width 3.5m
	Shoulder	Standard Section (Start point-STA.807+20)	2.5 m	● Widened shoulder was applied with considerations for gender equality, school children use and low-speed vehicles
		Bokhtar Section (STA.807+20-End point)	1.75 m	
	Median	Standard Section (Start point-STA.807+20)	3.0 m	● These widths include marginal strip (inner shoulder) of 0.5m.
		Bokhtar Section (STA.807+20-End point)	2.0 m	

Type	Item		Quantity	Remarks
	Sidewalk		2.25 m	● On both sides
	U-turn Lane		2 locations	● STA.737+20: One-direction (Bokhtar to Bokhtar) ● STA.802+60: Both-directions
Structure	Cross Drainage (Precast box culvert)		16 locations	● 8 locations for irrigation ● 8 locations for drainage
	Box Culvert		2 locations	● Replacement of existing bridges (No.15 & No.16)
	Road Surface Drainage	L-type Gutter	13 km	● For road surface drainage
		U-type Gutter	14 km	● For road surface drainage and toe of slope
Road Ancillary	Zebra Crossing (Unsignalized)		7 locations	● Where access roads are connected to the project road.
	Road Marking for Speed Reduction		7 locations	● Installed ahead and forth of zebra crossing in the longitudinal direction
	Regulatory Sign		All sections	● According to SNiP and GOST
	Reflective road Studs		5 km	● Installed at every 10m interval in sections where street lights are not provided
	Shoulder rumble strips		18 km	● Installed outside of shoulder line
	Pedestrian Guardrail		14 km	● In the section where embankment height is 3m or more
	Gravity Walls		82.4 m	● For adjusting difference in height to the existing ground level
	Bus Bays		8 locations	● Installed at/nearby the existing bus bays
	Revetment		2 rivers	● Upstream and downstream of No15 and No.16 box culverts
	Signalized Intersections		2 locations	● STA.774+60 and after STA.820
	Street Lights		4 km	● In the section of zebra crossing and signalized intersection

(2) Typical Cross Section

As mentioned in 2.1.2 and 2.1.3, there are two types of cross sections depending on the location, that is, standard section (from STA.730+50 to STA.807+20) and Bokhtar section (STA.807+20 to STA.822+10.799) as illustrated in Figure 2.2-23and Figure 2.2-24.

Cross section in the Bokhtar section is elaborated in 2.2.1.3.

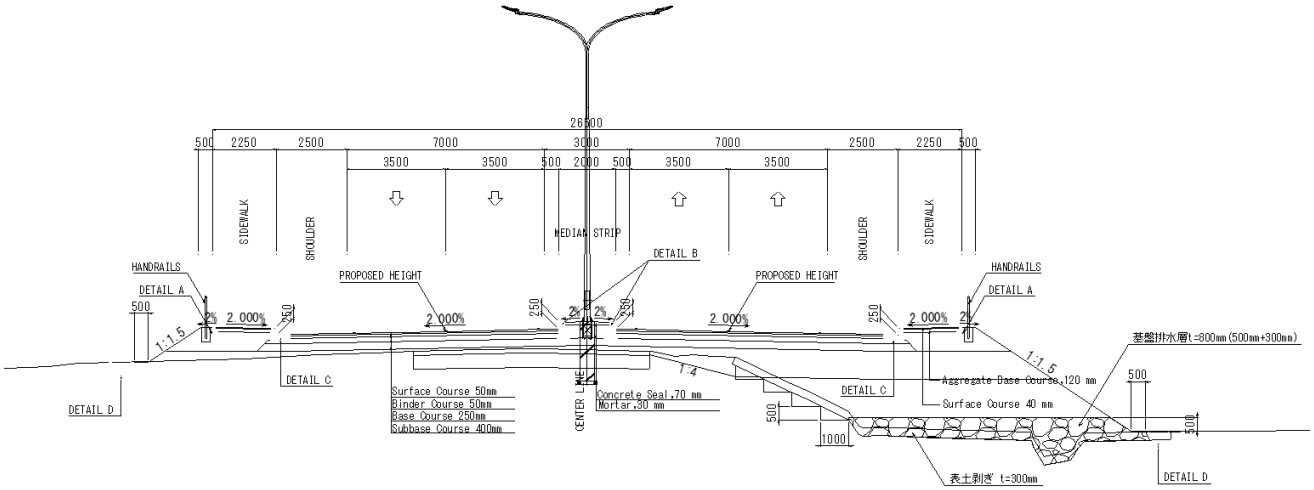


Figure 2.2-23 Typical Cross Section in the Standard Section (STA.730+50 to STA.807+20)

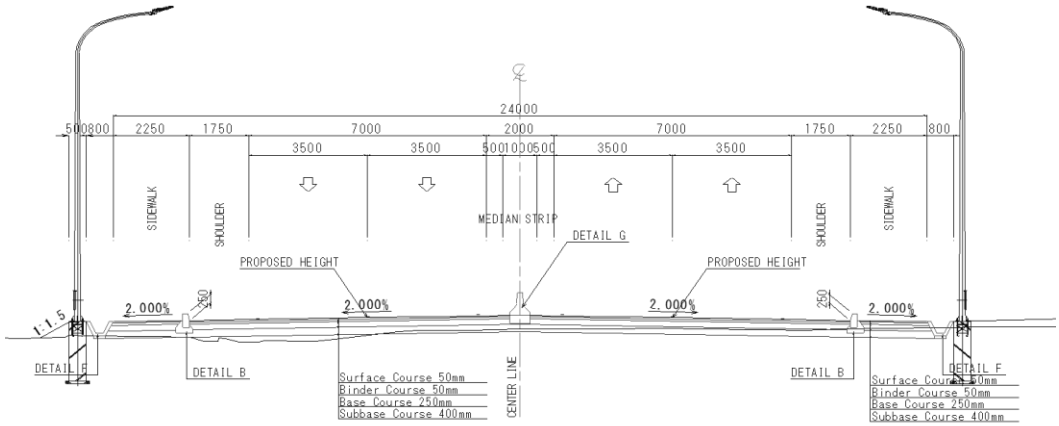


Figure 2.2-24 Typical Cross Section in the Bokhtar Section (STA.807+20 to STA.822+10.799)

2.2.3.2 Road Plan

(1) Basic Policy

Basic policy on road plan by category is summarized in Table 2.2-9.

Table 2.2-9 Basic Policy on Road Plan

No.	Category Item	Policy
1	Consistency with On-Going Project in ADB Section	● Maintaining road continuation of the DB Road ● Consistency with design concept of ADB section
2	Traffic Safety	● Planning to ensure existing road functions such as securing all drainage crossings and existing traffic movement
3	Horizontal Alignment	● Horizontal transition shall be done by applying the 'Shift by Straight Line' method that enables the drivers to maneuver the vehicle more smoothly than the 'Shift by Curve' method in case that small shifting of horizontal alignment is required.

No.	Category Item	Policy
4	Vertical Alignment	● New vertical alignment shall be slightly elevated from existing road surface for strengthening of pavement structure, with consideration for status of roadside land use and road user's convenience.
5	Cross- section Element	● Considering status of status of roadside land use and traffic safety, layout and setting of cross-section element shall be studied. ● New road width shall be settled inside existing ROW to the possible extent.
6	Technical and Economic Viability of Japan Grant Aid	● Considering project cost, construction plan and environmental consideration of ADB section, verification as Japan Grant Aid shall be made.

(2) Design Condition

1) Geometric Condition

Road geometric condition is shown in Table 2.2-10.

Table 2.2-10 Road Geometric Condition

No.	Item	Standard Value	Applied	Remarks
1	Regulated vertical limit	4.5 m	7 m	SNiP
2	Necessary overhead clearance from road surface to electric lines	7 m	7 m	
3	Design speed	100 km/h	100 km/h	AH standard
4	Number of lanes	4	4	
5	Lane shifting length	120 m	120 m	SNiP or equivalent
6	Min. Horizontal radius of curvature	350 m	5,000 m	Preferable value: 600 m
7	Minimum Horizontal curvature length	200 m	318 m	SNiP
8	Maximum Radius for use of Spiral Curve Transition	1500 m	N/A	AH standard
9	Minimum parameter of spiral curve	85 m	N/A	AH standard
10	Stopping sight distance	200 m	200m	SNiP
11	Maximum longitudinal gradient	4.0% (Limit: up to 700m) 3.0% (Limit: up to 900m)	1.2%	AH standard
12	Radius of vertical curvature	Crest:10,000 m	10,000 m	SNiP
		Sag: 3,000 m	7,100 m	
13	Crossfall	2.0%	2.0%	AH standard
14	Maximum Superelevation	10.0%	2.3%	AH standard
15	Longitudinal Slope/ Vertical gradient	Embankment 1:1.5 or less Cut: 1:1.0 or more	Embankment 1:1.5 Cut: 1:1.0	SNiP

2) Design Vehicle

WB-19 defined in AASHTO and shown in Figure 2.2-25 is applied as design vehicle. Size of this vehicle type covers the largest vehicle (L=20m) under Decree No.779 in Tajikistan.

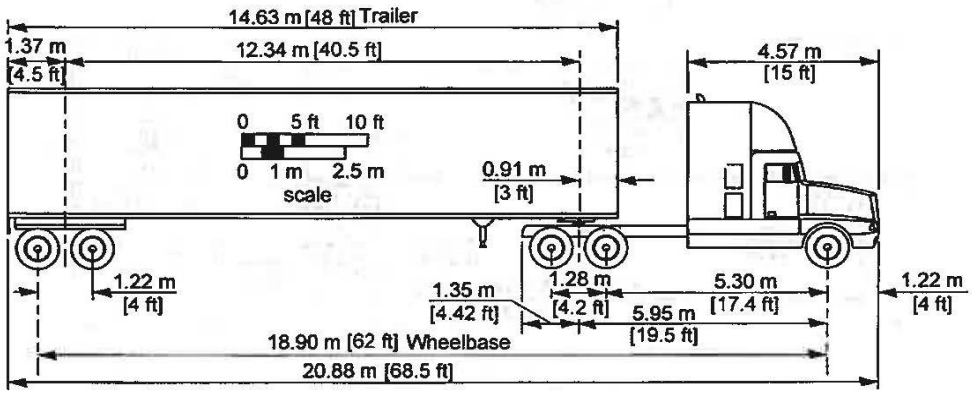


Figure 2.2-25 Design Vehicle W-19

(3) Control Points

Various control points were identified along the objective section. The points identified were prioritized based on the sensitivity and complexity with respect to relocation. Policies against each of these points were set for delineation of the horizontal alignment. The control point types, its priority and policy to be applied are summarized in Table 2.2-11.

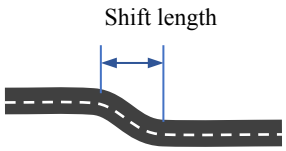
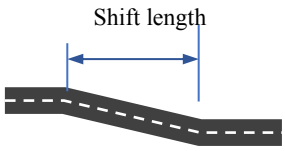
Table 2.2-11 Policy on Handling Control Points

Control Points	Priority	Policy
Steel tower, power transmission line, transformer	1	Absolutely avoided
Settlement, graveyard		
Commerce facility	2	Avoided to the possible extent
Other robust facilities		
Electric pole, communication cable, water pipe, etc.	3	Relocation

(4) Horizontal Alignment

Horizontal alignment is planned taking the afore-mentioned policies against the controls points, the existing Right-of-Way (ROW) and the existing road alignment into consideration. Where the new alignment deviates from the existing, transition is planned by applying the 'Shift by Straight Line' method, as this enables the drivers to maneuver the vehicle more smoothly than the 'Shift by Curve' method and for other reasons shown in Table 2.2-12.

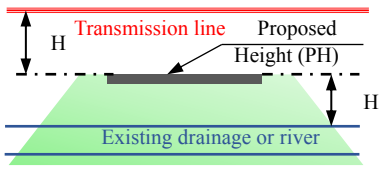
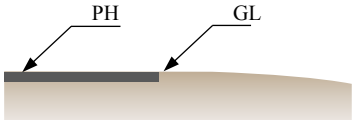
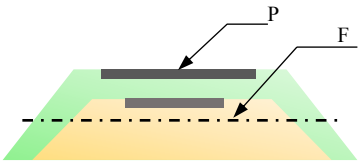
Table 2.2-12 Policy on Horizontal Alignment Layout

Item	Shift by curve	Shift by straight line
Image		
Shift length	○ (Shorter)	△ (Longer)
Widening at the corner	△ (required depending on the radius)	○
Mobility	△	○
Landscape	△	○
Evaluation	△	○

(5) Vertical Alignment

Overhead transmission lines, elevation of existing drainage facilities, thickness of existing basecourse, which where applicable is used as subgrade of the new pavement, underground water level and the check points shown in Table 2.2-13. Table 2.2-13 are considered in planning the vertical alignment. The elevation of necessary facilities and structures to be provided for maintaining basic functions are also taken into consideration.

Table 2.2-13 Main Check Points for Planning of Vertical Alignment

No.1 Vertical Clearance: H	No.2 Height of access road: GL	No.3 Height of existing basecourse: FH
	 * Superelevation shall be considered.	

(6) Cross-Section Element

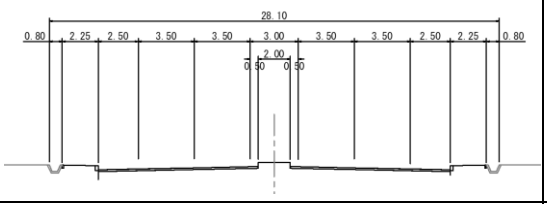
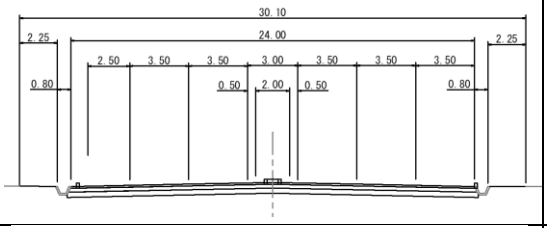
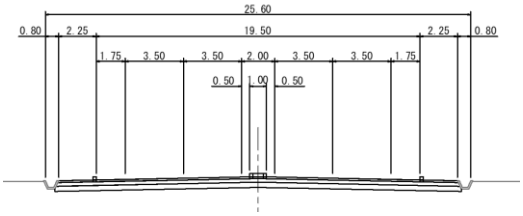
1) Basic Policy

The Decree of the Government of Tajikistan as of 6th of May 2005 under #214 designates the ROW of the objective road 25 m on each side. However, there are sections where houses and farmlands are located within the ROW. The improvement and/or widening of the existing road is planned, to the possible extent, such that influence to or relocation of these facilities are minimal.

2) Typical Cross Section in Bokhtar City

Typical cross section in Bokhtar City was determined based on the comparison between three conceivable alternatives. Alternative 3, which has least impact to the surrounding environment was selected. The alternatives, application reason and impact for each alternative are shown in Table 2.2-14.

Table 2.2-14 Comparative Study on the Road Width in Bokhtar Section

No.	Alternative	Application Reason	Cross-section Element	Impact	Recommendation
1	Similar to standard section (In total 28.10m)	Maintaining of continuation of DB road		・5 houses ・4 street stall ・3 fuel station	△
2	Based on Bokhtar urban development plan (In total 30.10m)	Considering request of Bokhtar city		・5 houses ・4 street stall ・4 fuel station	△
3	Minimum impact (In total 25.60m)	Applicable to the future Bokhtar urban development plan and minimum impact to roadside environment		・3 houses ・4 street stall	○

3) Consolidation Settlement and Stability of Foundation Ground in Embankment Section

For consolidation settlement and stability of foundation ground of embankment, engineering judgement based on the soil investigation result was made.

The result of geo-technical investigation conducted at near STA.734 indicates presence of a 7.45 m thick layer of viscous soil. However, N value measured at the middle of the soil layer is 27 and the content of natural water is 30%. Consolidation settlement generally occurs for a viscous soil having the N values less than 4 and 40% of natural water content Therefore, no consolidation settlement is anticipated.

4) Slope Gradient

Slope gradient is set as follows in accordance with SNiP.

- Embankment V : H = 1 : 1.5 or more
- Cut V : H = 1 : 1.0 or less

(7) Road Surface Drainage

1) Design Policy

Currently, there is no road surface drainage on the existing road. Surface water due to rainfall is naturally drained to outside and downside of the road. However, planning of road surface drainage is undertaken in this project for the following reasons.

- Provision of mount-up type sidewalk at both sides of the road blocks the water from flowing out.
- Widening from 2 lanes to 4 lanes increases the drainage basin (area) (roughly more than twice the initial drainage area).
- Prevent infiltration of water from the slope.

2) Design Condition

According to AASHTO or Japanese Standard, minimum longitudinal gradient of the road is basically determined by the drainage gradient that is 0.3 to 0.5%.

However, although the major portion of the existing road is constructed slightly above the existing ground, the vertical alignment is relatively flat, with gradient less than 0.3%. In order to address this issue, L-type gutter was applied as road surface drainage facility which is commonly used in urban area. The basic configuration is shown in Figure 2.2-26. Collected surface water is drained through the catch basin and drained out to natural ground (Figure 2.2-27). In layout of catch basin, it was allowed for drainage water to pass through for 1.5m outside of 2.5m shoulder as waterway under condition where intensity of rainfall is 23.0 mm/hr. regulated in SNiP.

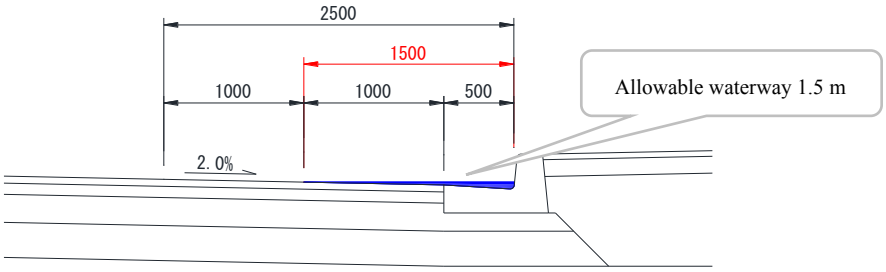


Figure 2.2-26 Expected Waterway on L-type Gutter

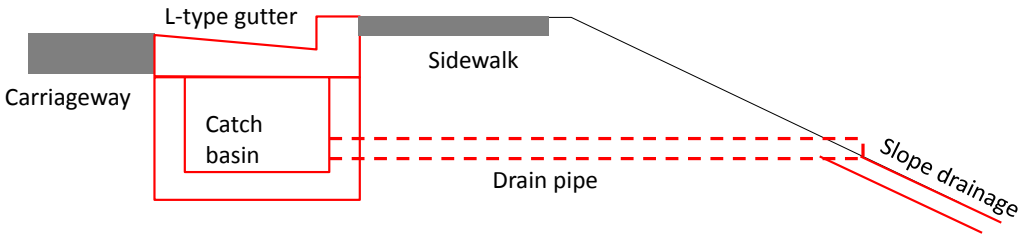


Figure 2.2-27 Explanation of Slope Drainage

3) Drainage Outlet

As summarized in Table 2.2-15, rainwater collected is drained in two ways. Where the embankment height is more than a meter, natural treatment, where the rainwater is allowed to infiltrate in the earth is applied. Where the embankment is less than a meter, the water collected is transported to the drainage outlet (existing drainage facility).

Table 2.2-15 Flow End Treatment

Type	Condition	Treatment method
Natural treatment	Embankment height is 1.0m or more	Infiltration
Forced treatment	Embankment height is 1.0m or less	Guided to the drainage facility nearby

2.2.3.3 Intersection

(1) Design Policy

There are existing intersections at STA.774+60 and at STA.820 in the objective section. These intersections need to be improved following widening of the road. Improvement policies for each intersection are discussed hereunder.

a) Intersection-01: Entrance to the University (around STA.774+60)

- Traffic signal operation will be applied.
- Improvement of secondary road (other legs of the intersection) will not be included in the project scope as the present traffic volume on these legs is relatively low.
- Improvement will be done to incorporate widening of the objective road.
- Exclusive lanes for vehicles turning left will be provided on the objective roads.

b) Intersection-02: Entrance to the Bokhtar City (around STA.820)

- At-grade signalized type intersection will be applied with consideration for social and environmental considerations to roadside land use including economic and technical viability as Japan's grant aid.
- Since this intersection is crucial as connecting point between AH and the Bokhtar City, shape and scale of intersection will be based on the future traffic analysis result.
- The exclusive lanes and traffic signals will be provided in accordance with the analysis result.

(2) Comparative Study on Type of Intersection-02

1) Applicability to the Intersection of Roundabout

According to the guideline in US, which is "Roundabouts: An Informational Guide Second Edition"(NCHRP Report 672、FHWA), general roundabout design guide is shown based on the

statistical data. Especially, relation between traffic volume and diameter of the roundabout is mentioned as shown in Figure 2.2-28.

Objective future traffic volume in this project is 37,000 vehicle / day and it corresponds to " Multilane Roundabout " highlighted by red line in the figure. In accordance with this, 46 m to 91 m of diameter is required.

Roundabouts: An Informational Guide

Exhibit 1-9
Roundabout Category Comparison

Design characteristics of the three roundabout categories.

Design Element	Mini-Roundabout	Single-Lane Roundabout	Multilane Roundabout
Desirable maximum entry design speed	15 to 20 mph (25 to 30 km/h)	20 to 25 mph (30 to 40 km/h)	25 to 30 mph (40 to 50 km/h)
Maximum number of entering lanes per approach	1	1	2+
Typical inscribed circle diameter	45 to 90 ft (13 to 27 m)	90 to 180 ft (27 to 55 m)	150 to 300 ft (46 to 91 m)
Central island treatment	Fully traversable	Raised (may have traversable apron)	Raised (may have traversable apron)
Typical daily service volumes on 4-leg roundabout below which may be expected to operate without requiring a detailed capacity analysis (veh/day)*	Up to approximately 15,000	Up to approximately 25,000	Up to approximately 45,000 for two-lane roundabout

*Operational analysis needed to verify upper limit for specific applications or for roundabouts with more than two lanes or four legs.

Figure 2.2-28 Excerpt from Roundabouts: An Informational Guide

Figure 2.2-29 illustrates in case that minimum diameter of 46 m is applied. If exclusive right-turn lanes are added, affected area is expanded. With this case, area for bus and taxi terminal located in the southeast will be reductive and convenience for road users will be reduced.

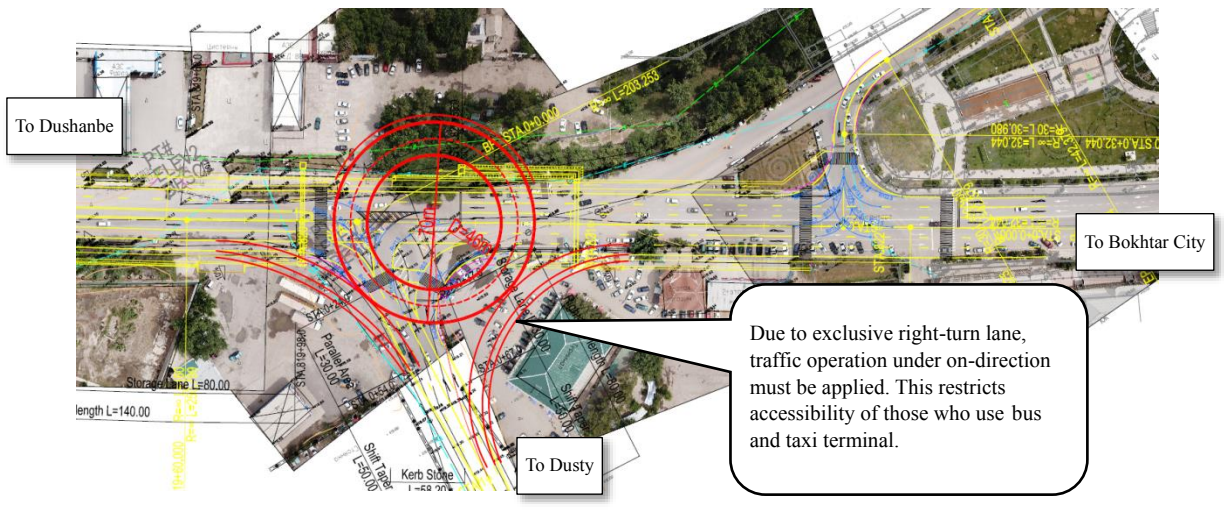


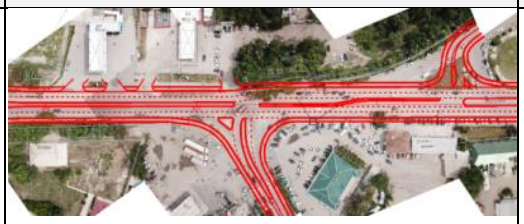
Figure 2.2-29 Layout Plan in Case of 46 m Roundabout

2) Comparative Study on Type of Intersection-02

A typical at-grade signalized type and roundabout type improvement methods (alternatives) were considered and compared against traffic and pedestrian safety, environmental impact and

maintenance, as shown in Table 2.2-16. The Type-1 was recommended as it superior than Type-2 in terms of safety (traffic and pedestrian), environmental impact and maintenance.

Table 2.2-16 Comparative Study on Type of Intersection-02

Alternative	Type-1: Typical at-grade signalized type		Type-2: Roundabout	
Plan outline				
Traffic signal	○		×	
Safety	High: No conflict of vehicles each other when in turn-left under signalized operation	○	Low: Conflict of vehicles at merge sections under 2-lane circular operation	×
Convenience for pedestrian	High: Short distance for crossing and safety under signalized operation	○	Low: Long distance for crossing	×
Environmental impact	Small: More compact shape than the roundabout type	○	Large: Large impact to the surrounding area	×
Maintenance	Maintenance of traffic signal	×	Maintenance inside the roundabout	○
Recommended	○		△	

(3) Traffic Analysis

1) Methodology

Analysis is based on the methodology indicated in the Highway Capacity Manual 2010. The target level of Service (LOS) is 'D'.

2) Analysis Condition

The conditions applied for the analysis is shown in Table 2.2-17.

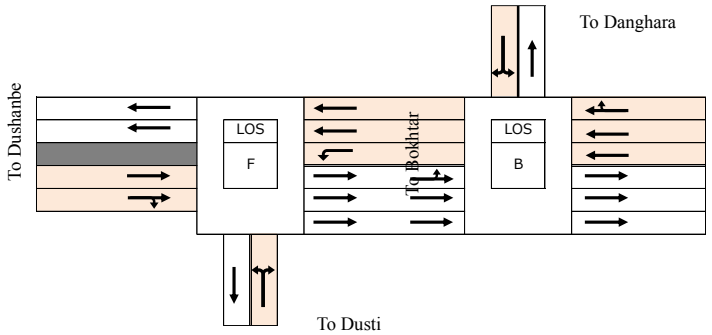
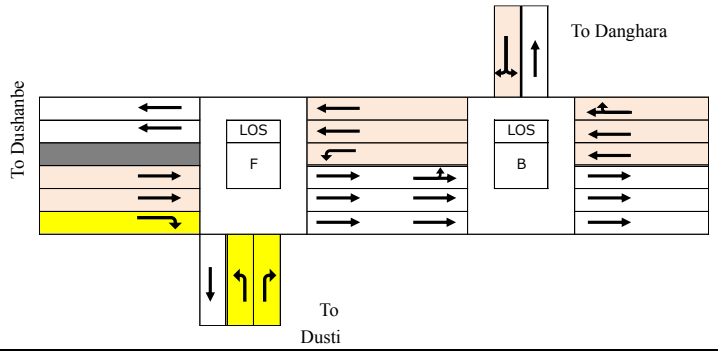
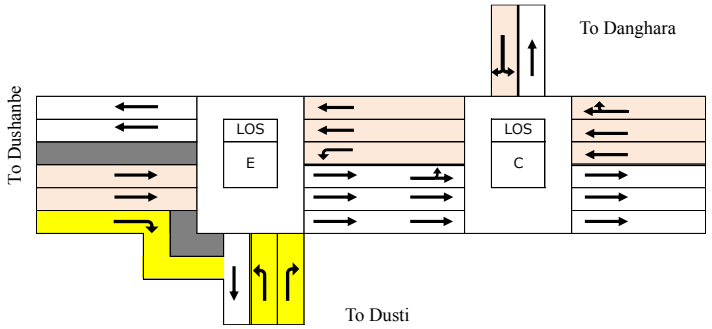
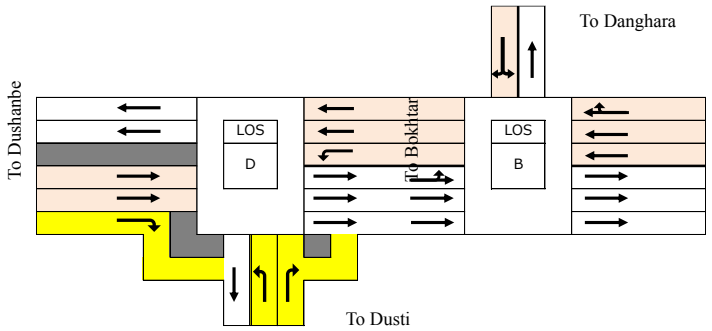
Table 2.2-17 Analysis Condition

Item	Condition / Input	Note
Input traffic volume	In the peak time as of 2041	According to OD survey result, 24hours-traffic volume survey result was allocated to each inflow lane
Target	Intersection-02	Concurrent analysis for both intersections was made due to being close-set each other.
Operation type	Signalized	Signalize intersection was expected since 2-inflow-lane will be provided after completion of the project.
Shape of small intersection located in the Bokhtar direction	Integrated-orthogonal type	Although a current shape of this intersection is being deformedly crossed, the future shape shall be orthogonal type due to securing of traffic safety and mitigating traffic accident

3) Analysis Result

The analysis result is summarized in Table 2.2-18. From this, Case-4 was applied in this project.

Table 2.2-18 Analysis Result

Alternative	Plan outline	Result
Case-1 Minimum impact ● 2-lane carriageway in the Dushanbe side ● Outside lane shall be shared by through and right-turn traffic		Impossible to handle traffic volume at main intersection
Case-2 Additional auxiliary lane ● Right-turn lane shall be provided under traffic signal operation		Impossible to handle traffic volume at main intersection
Case-3 Strengthening of AH direction (1) ● Exclusive right-turn lane from Dushanbe to Dusti		Impossible to handle traffic volume at main intersection
Case-4 Strengthening of AH direction (2) ● Exclusive right-turn lane from Dushanbe to Dusti ● Free right-turn lane from Dusti to Bokhtar		Possible to handle (Applied)

(4) Design Condition

Design conditions applied for improvement of the intersection are shown in Table 2.2-19.

Table 2.2-19 Design Condition

Item	Applied	Note
Design speed	60km/h	60km/h was regulated nationwide in Tajikistan for the urban areas
Exclusive right-turn	As mentioned above	As mentioned above
Design vehicle	WB-19(AASHTO)	As mentioned above
Chevrons	Determined by vehicular swept path of WB-19	Traffic island shall be installed where is connected to zebra crossing, and chevrons by road marking shall be installed for the others.
Storage lane length for right and left turn lane	80m	According to SNIP

(5) Intersection Plan

Figure 2.2-30 and Figure 2.2-31 illustrate intersection plans.

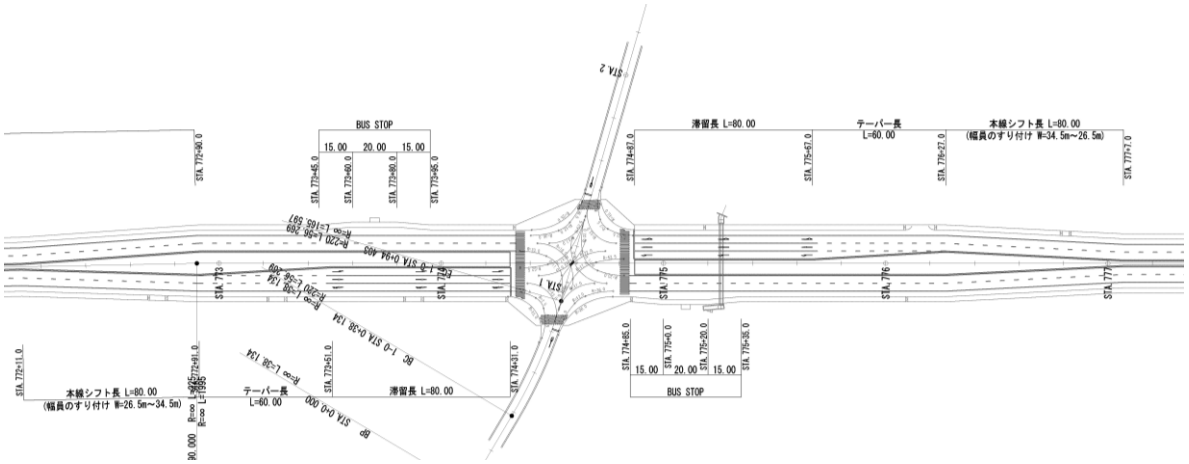


Figure 2.2-30 Intersection-01

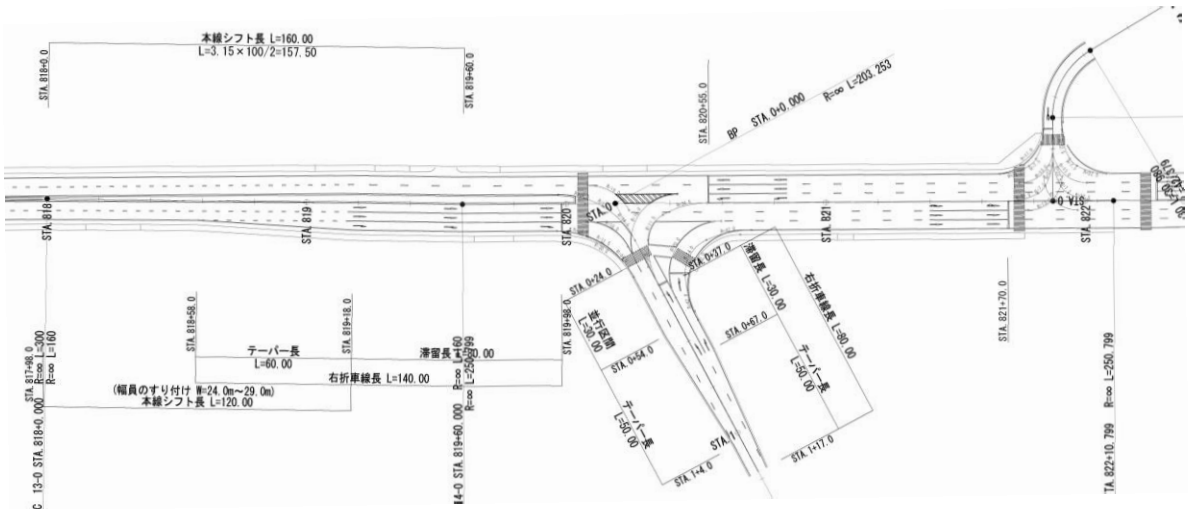


Figure 2.2-31 Intersection-02

2.2.3.4 U-Turn Lane

(1) Design Policy

Widening of the existing road to 4-lanes from its present 2-lanes plans to provide a median strip to separate opposing lanes of traffic. Provision of such median deprives access from and to the abutting properties that was entertained by the locals prior to the widening. Therefore, in order to assure the initial access function, U-turn lanes are provided.

(2) Design Condition

Design conditions are shown in Table 2.2-20. Size of the facilities was determined such that design vehicles of 6m long can turn simultaneously to either direction, or in case of WB-19, it can take a turn using full paved area including shoulder width based on vehicular swept path (refer to Figure 2.2-32).

Table 2.2-20 U-Turn Lane Design Conditions

Item	Applied	Note
Design vehicle	L=6m	Allow WB-19 (L=20m) to turn round using full paved area
Width of median openings	W=12 - 15m	
Widened shoulder	W=4.0m	

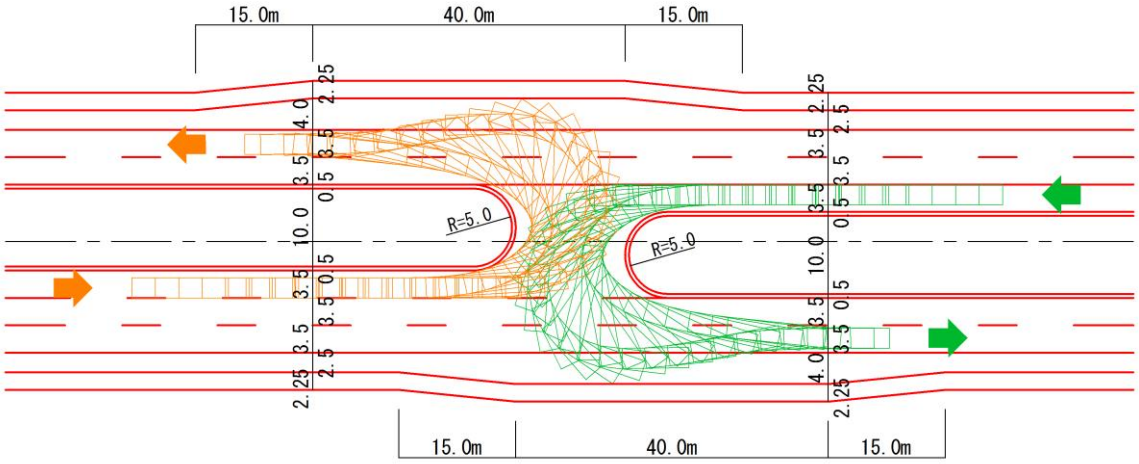


Figure 2.2-32 Vehicular Swept Path

(3) Installed Location of U-Turn Lane

After discussion with the MOT and the traffic police, two U-turn lanes were planned as shown in Figure 2.2-33. Layout is based on Tajikistan standard, which stipulates provision of one u-turning lane in every 3km. Based on the standard, U-turn lanes are provided at STA.737+20 and STA.802+60. The U-turn lane at STA.737+20 will allow u-turning from only one direction (Bokhtar to Bokhtar), while the one at STA. 802+60 will allow u-turning from both directions.

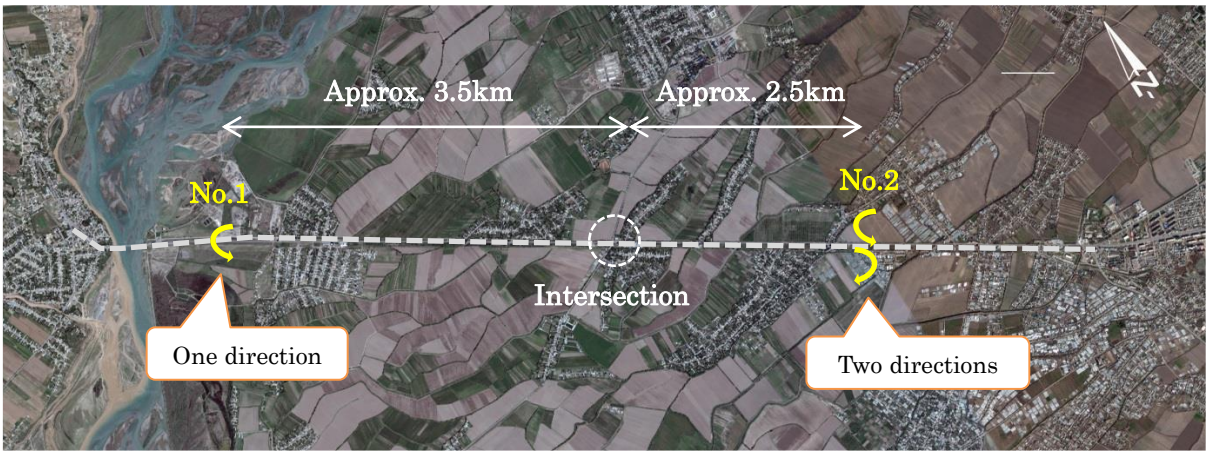


Figure 2.2-33 Installed Location of U-Turn Lane

(4) Plan Drawing

U-turn lane plan is shown in Figure 2.2-34.

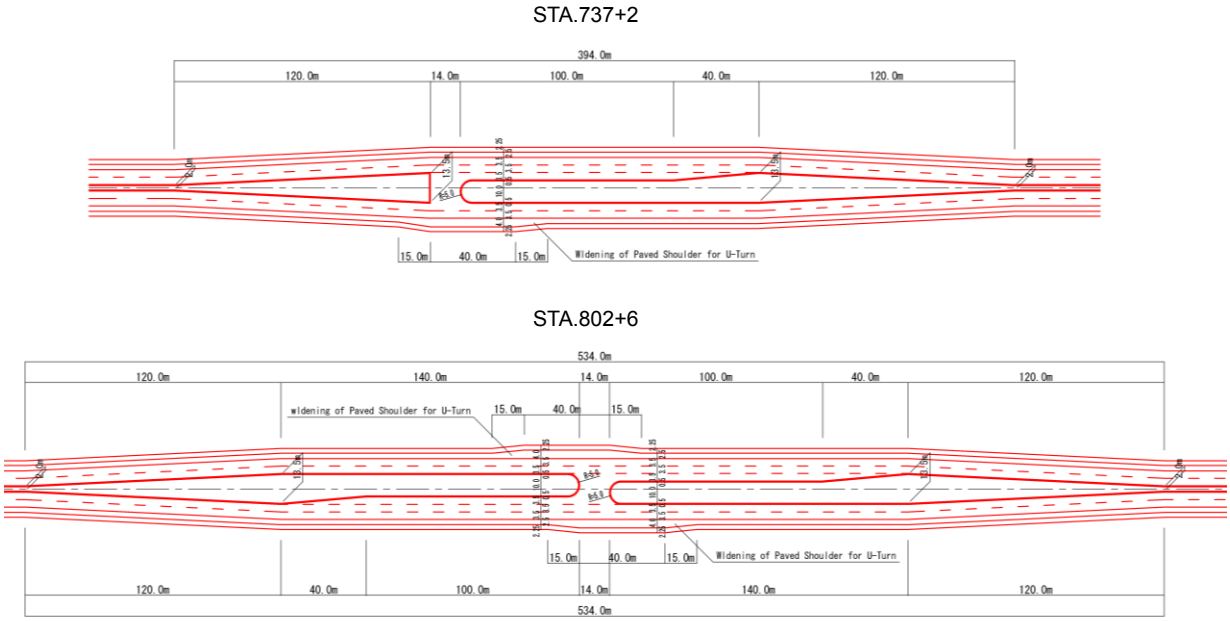


Figure 2.2-34 U-Turn Lane Plan

2.2.3.5 Pavement

(1) Current Situation

Overlay has been typically used as pavement repair in Tajikistan. However, it is confirmed that pavement repair by overlay was just made to put asphalt concrete on the existing pavement without considering condition and evaluation of soundness of basecourse. Therefore, reflective crack on the pavement surface is observed.

(2) Design Policy

Policies for pavement design are as following.

- Flexible pavement which is common in Tajikistan shall be applied.
- Design calculation will be based on the CBR test result
- Study of pavement structure considering heavy traffic, and countermeasure for it
- Applying prevention measures for crack to be expected to occur at the border between the existing and new pavement
- Determining proper parameters for calculation
- Study on frost heaving
- Calculating by AASHTO method similar to ADB section

(3) Performance Period

As mentioned in 2.2.2.1(4), performance period of pavement shall be 15 years.

(4) Calculation by AASHTO

1) Design Parameters

Design parameters are summarized in Table 2.2-21. The Structural Number (SN) required for the asphalt pavement will be calculated from the following formula.

$$\begin{aligned} Log_{10}(W_{18}) &= Z_R \times S_0 + 9.36 \times Log_{10}(SN+1) - 0.20 + \frac{Log10\{\Delta PSI/(4.2-1.5)\}}{0.40 + \{1094/(SN+1)^{5.19}\}} \\ &\quad + 2.32 \times Log_{10}(M_R) - 8.07 \end{aligned}$$

Table 2.2-21 Design Parameters (Inputs) of Pavement Design

Item	Description	Design Condition	Remarks
Design Period	The period that an initial pavement structure will last before it needs rehabilitation.	15 years (2020 – 2034)	
Traffic Load	The traffic load is expressed by cumulative number of 18-kip equivalent single axle load (ESAL) applications (w_{18}) during the performance period and is calculated based on the future traffic volume which is converted to 18-kip ESALs applying the axle load equivalency factors given in the AASHTO Guide.	Calculated by traffic demand forecast	
Reliability	Means of incorporating some degree of certainty into the design process.	● The level of reliability (R)=95% ● Standard normal deviate corresponding to level of reliability (Z_R) = -1.645 ● Combined standard error of the traffic prediction and performance prediction (S_o) = 0.45	

Item	Description	Design Condition	Remarks
Performance Criteria	The Present Serviceability Index (PSI) is used to represent pavement performance. The total change in PSI (△PSI) is defined as the difference between initial serviceability index (p_0: value immediately after construction) and terminal serviceability index (p_t: lowest index that will tolerate before rehabilitation, resurfacing or reconstruction)	p_0 = 4.2 pt = 2.5	p_0=4.2 pt=2.5 △PSI=1.7
Roadbed Soil Property	The resilient modulus (M_R) is used. The AASHTO Guide introduces the equation estimating M_R from CBR as M_R = 1,500 x CBR (CBR is regarded as 20 in case of CBR more than 20)	CBR=10 (calculated based on CBR investigation)	M_R=15,000psi
Pavement Layer Material Properties	The pavement strength is expressed by the structural number (SN) which is calculated as: $SN = a_1D_1 + a_2D_2m_2 + a_3D_3m_3$ where a_i=i^{th} layer coefficient D_i=i^{th} layer thickness (inches) m_i=i^{th} layer drainage coefficient	● Asphalt concrete wearing course: a1=0.44 ● Asphalt concrete binder course: a2=0.42 ● Basecourse : :a4=0.14 ● Sub-basecourse : a 5 =0.11	
Drainage Condition	The factor to modify the SN considering the effects of drainage.	m_4=m_5=1.0 (water removed within 1 week, and pavement structure is exposed to moisture levels approaching saturation during 5% of the year)	

2) Estimation of ESAL (Equivalent Single Axle Load)

In the "Data Collection Survey on a Road between Dushanbe and Kurgan-Tyube" conducted by JICA, axle load survey and calculation of LEF (Load Equivalency Factor) on the basis of actual traffic sample in Tajikistan was conducted. This LEF was used as LEF for pavement calculation even for this project. Future traffic volume mentioned in 2.2.2.1(2) is converted into ESAL by applying LEF as shown in Table 2.2-22.

Table 2.2-22 LEF

Type	Applied	[For reference] Applied in ADB section
Passenger car	0.01	0.01
Small bus	0.01	0.01
Large bus	1.28	1.28
Biaxial truck	1.148	1.148
Triaxial truck	3.484	3.275
Trailer more than 4 axial	5.629	3.785

3) Verification of ESAL

ESAL is estimated at approximately 24 million in this project. On the other hand, ESAL that was previously used when ADB designed this section was approximately 25 milion. Although LEF is different, estimated ESAL was about the same.

4) Calculation Result

The result is shown in Table 2.2-23.

Table 2.2-23 Pavement Calculation Result

Pavement Layer Material		Layer Coefficient (a)	Thickness (inch) (D)	Drainage Coefficient (m)	SN = a*D*m	Thickness(cm) (D)
Wearing course	(Asphalt)	0.440	1.969	—	0.866	5
Binder course	(Asphalt)	0.420	1.969	—	0.827	5
Basecourse	(CBR 80%)	0.140	9.843	1.00	1.378	25
Sub-basecourse	(CBR 30%)	0.110	15.748	1.00	1.732	40
Total			4.696	＜	4.803	75

(5) Frost Heaving

According to the design report of ADB Phase-2, frost depth in the Bokhtar Area is 17 cm. On the other hand, Catalog for the climate of the USSR, 1966 mentions that maximum frost depth at Bokhtar Area is 26 cm. As noted above, since material of designed base course and sub-base course is expected to be gravel that has high permeability, and either depth of the frost heave lies within the base or sub-base course, it is judged that influence from frost heaving is negligible.

(6) Groundwater Level

In order to evaluate how the ground water affects pavement structure, monitoring of the ground water level in the monitoring well, which was installed at STA.786 in May 2018 was carried out.

The groundwater level is around 1.5 to 2 m from bottom of planned subgrade. Therefore, the Team confirmed that the groundwater will not adversely affect pavement structure.

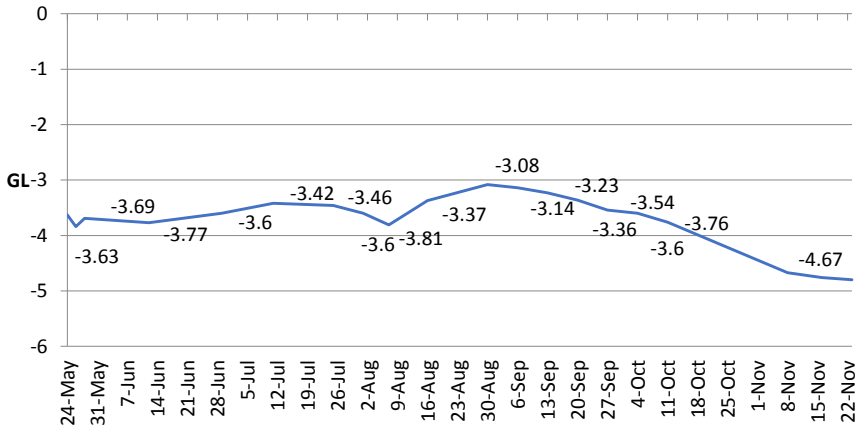


Figure 2.2-35 Monitoring Record of Groundwater Level

(7) Road Surface Temperature

Measurement of road surface temperature was conducted. The result is shown in Figure 2.2-36. From this figure, it was observed that the surface temperature in August almost reaches 60 degrees, beyond which bituminous material is subject to plastic deformation. As a measure to prevent plastic deformation from loads exerted by heavy vehicles, application of modified asphalt is proposed.

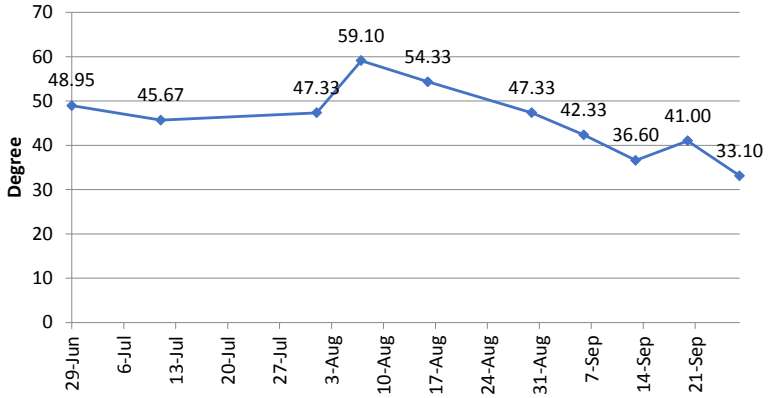


Figure 2.2-36 Monitoring Record of Road Surface Temperature

(8) Application of Modified Asphalt Concrete

In this project, modified asphalt concrete is planned to be provided on the wearing course only at intersection and U-turn lane sections where vehicles are anticipated to have low speed, subject to sudden and repeated acceleration and repeatedly intensive load.

(9) Basecourse Material

1) Base Course

Base course material shall be crushed stone with CBR80% or more.

2) Sub-base Course

Sub-basecourse shall be crushed stone or river bed material. According to the soil investigation result, it was found that CBR of the existing basecourse is more than 30% from STA.776+20 to the end point. Considering budgetary aspect, the existing basecourse shall be utilized.

3) Subgrade and Embankment

Subgrade and embankment shall be river bed material. CBR of the existing base course exceed 10% for most section in the project site, the existing base course shall be utilized as subgrade and embankment.

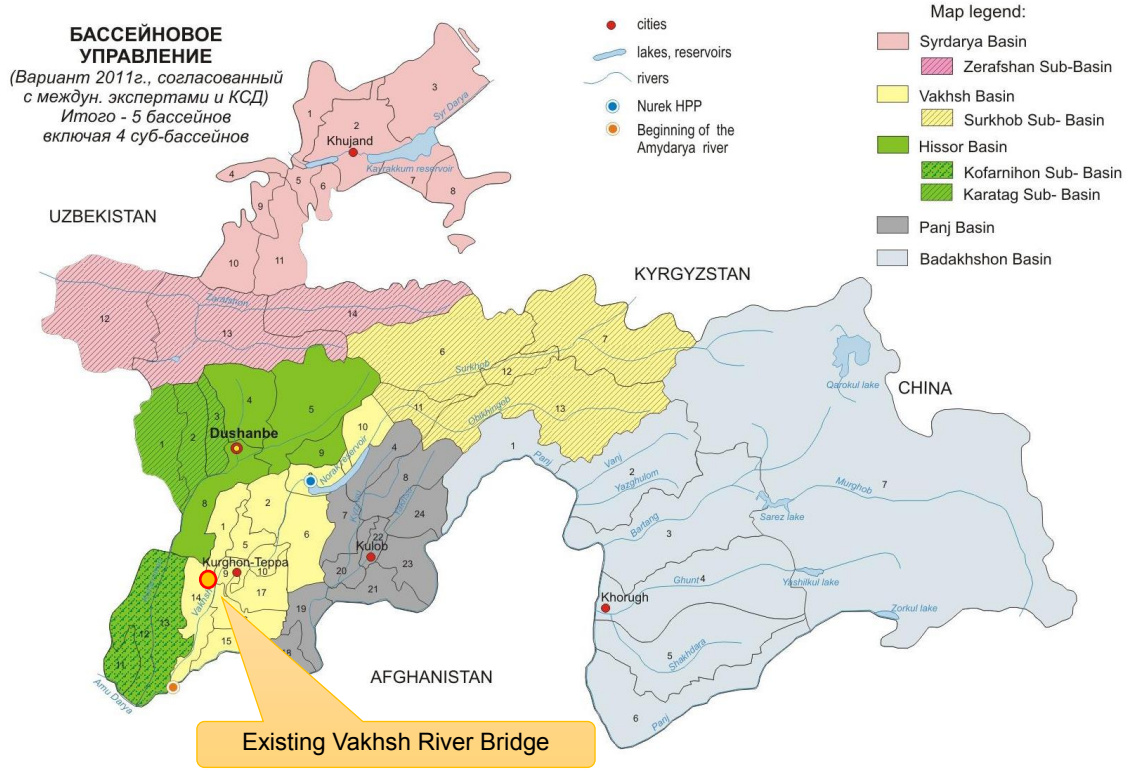
2.2.3.6 River, Drainage and Irrigation

(1) Current Conditions and Issues

1) Vakhsh River

a) General Condition

The Vakhsh River is an international river that originates in the Osh Valley in Kyrgyzstan, joining together with the melt of the Fed Chenko Glacier in Tajikistan, being confluent to the Pyandzh River (Amudalia River) near the Afghanistan border through the Pamir Plateau. The basin area is about 39,100 km2, and the river length is about 786 km. Figure 2.2-37 shows the outline of the river basin of Tajikistan.



Source: National Water Resources management Project Presentation Material, GIZ, 2017

Figure 2.2-37 Main river Basins in Tajikistan

The existing Vakhsh River Bridge near the start point of the project area is located from the alluvial fan to the natural levee section up to 120 km from the confluence point of the Pyandzh River, and there is a mountain area from 20 km upstream from the bridge. Five dams for hydropower generation, flood control, irrigation, etc. were constructed to support Tajikistan's economy in the upstream. Among them, Nurek Dam (completed in 1980) located in the uppermost stream of these dams is the world's largest earth dam of 304 meters high. Further upstream, Rogun Dam which is bigger than the Nurek Dam is under construction. Flood control is operated with these dam groups, and at the same time, the supply of soil and sand from the upstream is on a downward trend.

On the other hand, the discharge of the Vakhsh is largely influenced by the snow-fed water rather than the temporary rainfall, which is the maximum in the normal year in July and August when the inflow of molten water peaks. This means that the timing of the flow peaks in Vakhsh River differs from peak of irrigation and drainage channels affected by short rainfall.

b) Peak Flow and Peak Season at Vakhsh River Bridge

The condition around the Vakhsh River Bridge is shown in Figure 2.2-38. Vakhsh River is controlled by the Sarband dam located about 20 km upstream of the Vakhsh river bridge. The discharge amount from the dam is 20 m3/s to 5,000 m3/s. The peak season of discharge is from July to August, when the air temperature is the highest in the year, due to the influence of snow melting water in the upper stream of the Vakhsh River. As a result, the dam has released up to 3,500 m3/s every year in the past and never released 5,000 m3/s. Under this condition, flood damage from the Vakhsh River has never reported in project site.

On the other hand, the Loyqasoy River flows in from the right bank side 500 m upstream of the existing Vakhsh River bridge. This is used as a drainage channel, and it is about 50 m3/s at the normal time. Peak period is around March to May when rainfall is maximum. A comparison of the peak times of two rivers is shown in Figure 2.2-39.

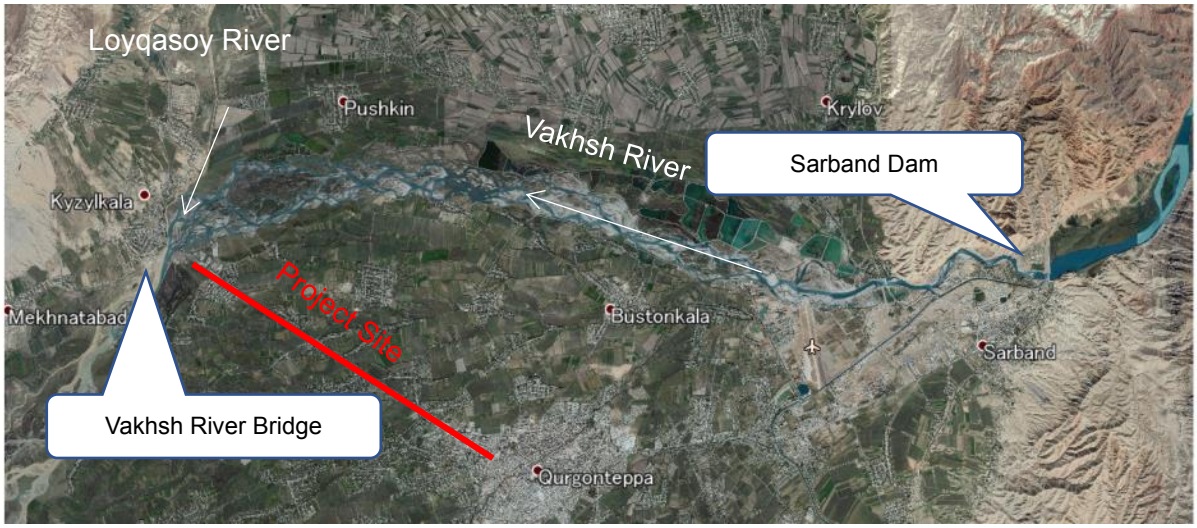


Figure 2.2-38 Condition of Vakhsh River

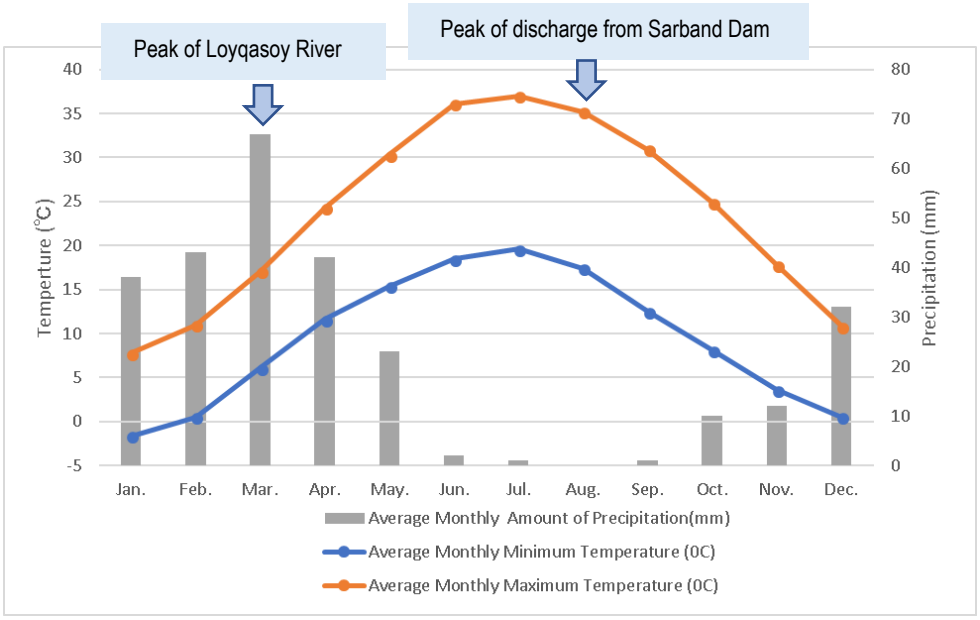


Figure 2.2-39 Meteorological Data of Bokhtar City and the Peak Season of Two Rivers

As described above, peak times of 2 rivers do not overlap. In addition, the discharge amount of the Sarband dam is 100 times larger compared to the discharge of the Loyqasoy River. As a result, the maximum discharge at the point of the Vakhsh River Bridge depends on the discharge amount of the Sarband dam.

It is undeniable that the maximum design discharge amount of 5,000 m3/s will be discharged due to future increases in Vakhsh flow caused by climate change. For this reason, the design discharge at the Vakhsh River Bridge is assumed as follows. For agricultural drainage, the wastewater volume is extremely small compared to the dam discharge volume and the Loyqasoy River flow, so they are not considered in the design discharge.

Estimated maximum flow rate at the Vakhsh River Bridge: 5,050 m3/s

(Assuming the maximum design discharge of the Sarband dam 5,000 m3/s + the constant discharge of the Loyqasoy River 50 m3/s, July - August)

c) River Discharge

A new bridge designed by ADB is planned immediately upstream of the existing bridge in the Vakhsh River. The flow capacity and the possibility of flood damage to the project area shall be confirmed.

i) Estimation of Recorded Maximum Water Level from Flood Mark

As shown in Figure 2.2-40, the flood mark remains on the existing Vakhsh River Bridge. This is the case when the maximum discharge amount of 3500 m3/s of the past flowed down. According to the survey, this height is EL398.997 m on the right bank side and EL 398.760 m on the left bank side. It is lower than the bank height of the upstream and downstream (upstream side EL 400.65 m, downstream EL 400. 37 m) of the existing road height of design start point (left bank side).

Figure 2.2-40 Flood Mark on Existing Vakhsh River Bridge

ii) Existing Water Level / Discharge Data

In the channels crossing the objective road, water level observation is not performed and there is no data.

Regarding the water level and discharge station of the Vakhsh River, the location is as shown in Figure 2.2-41. There are no observation stations near this project area. Station No. 48 (Beshaipalangon) exists downstream of the bridge, but it is close to the confluence point of the Piyanji River, about 40 km far from the project area. It is difficult to use the data of this station. The station No. 47 (Sarband) is near the upstream Norak dam. However, there are some dams between Norak Dam and the Vakhsh River Bridge. So, discharge data at this point is not helpful.

Based on the above conditions, the water level and discharge data of the drainage crossing the project area and the Vakhsh River shall be studied with the field survey result and the water level observation result carried out in this project.

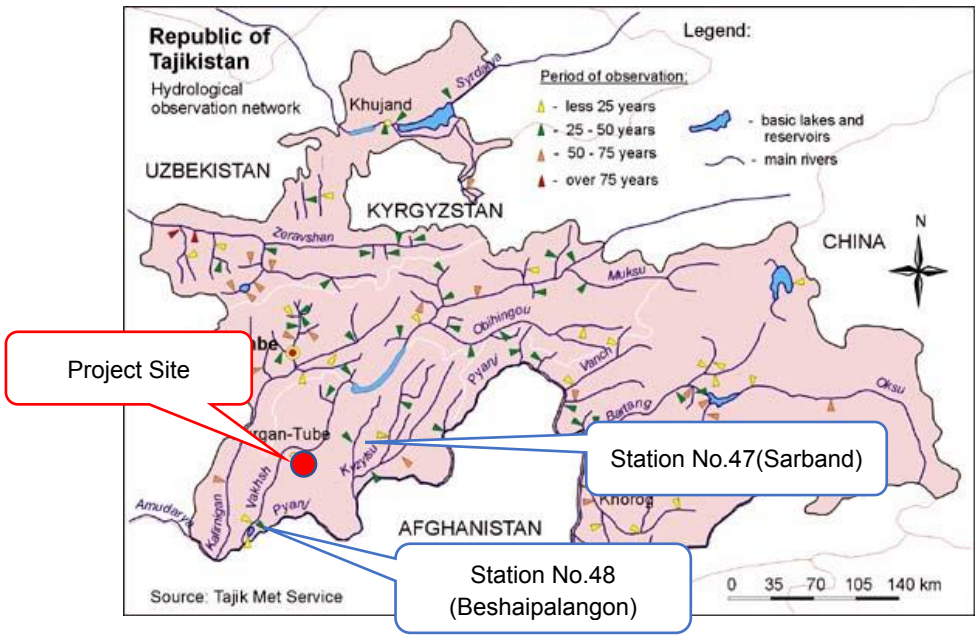


Figure 2.2-41 Location of Water Level Station in Tajikistan

iii) Water Level Observation

There is no water level observation station near the Vakhsh River Bridge. The nearest observatory is about 40 km downstream and cannot be referenced for this study area. For this reason, the river water levels are being observed and recorded twice a month from the end of May in this project. The peak of the discharge is considered to be around July to August.

The water level observation result and the condition of the Vakhsh River until September are shown below. Although the peak came in June after the rainy season, it decreased from there, and the highest water level was renewed in September. When comparing May and September, the water level is about 50 cm higher. The highest water level on 3 Sep is EL 397.17 m, about 1.6 m lower than the highest flood mark EL 398.76 m. In addition, there is a clearance of about 3.5 m from under the girders.

From this result, it is thought that the rainfall and the melting snow were small in this year, and the discharge from the Sarband dam was small as well.

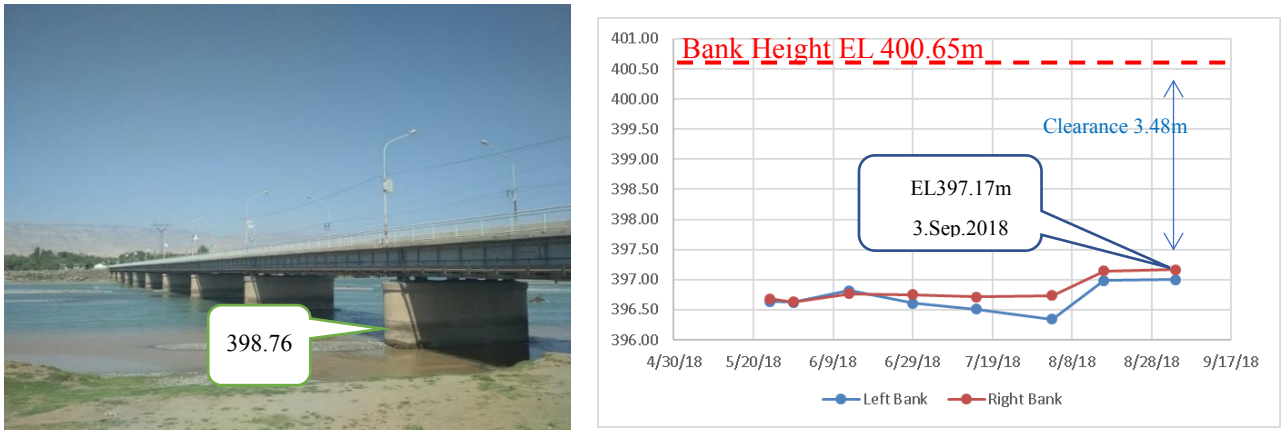


Figure 2.2-42 Water Level at Vakhsh River Bridge in August – September

d) Calculation of Flow Capacity

i) Calculation Method

On the site, the water level data is not sufficient; it is difficult to set the departure water level. In addition, since the bridge is located in the alluvial fan and the river bed is relatively steep, it is thought that the water depth becomes almost equal to the critical water depth (= normal flow depth). Therefore, the current falling ability is calculated by Manning's formula.

$$V = \frac{1}{n} \cdot I^{\frac{1}{2}} \cdot R^{\frac{2}{3}}$$

$$Q = A \cdot V$$

Q : Flow Capacity
V : Average Velocity(m/s)
I : River slope
n : Roughness Coefficient
A : Flow Area(m2)

ii) Calculation Conditions

Cross-sectional shape and riverbed slope was confirmed by survey (see Figure 2.2-43 and Figure 2.2-44). Regarding Manning's roughness coefficient, 0.03 was adopted from the local riverbed material. HWL adopted a height excluding the margin of 0.5 m from the current level of levee height and bridge beam height.

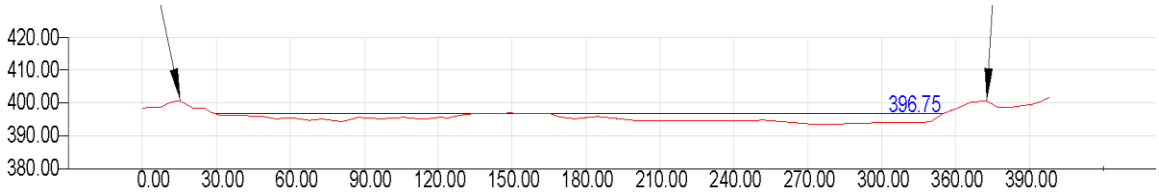


Figure 2.2-43 Cross Section(New Vakhsh River Bridge)

Figure 2.2-44 Condition of Planned Cross Section of New Bridge

dR：代表粒径	n：粗度係数		AとBの区分法
	A	B	
岩盤	0.035～0.050		A：河床が平坦で砂州が目立たない。また、表層に突出する粒径の大きな石が目立たない。 B：河床の凹凸が大きく粒径の大きな石が突出する。
玉石（40cm～60cm）	0.037	0.042	
玉石（20cm～40cm）	0.034		
玉石（10cm～20cm）	0.030		
粗礫［大］（5cm～10cm）			
粗礫［小］（2cm～5cm）	0.029		

注：1）はマニング・ストリクラーの式より求めた
2）はτ＊－φより求めた値。

Boulder(10-20cm):
Roughness Coeficient0.03

Source of the Table：Basic Policy of Japan to protect Beautiful Mountain and River

Figure 2.2-45 Roughness Coefficient

iii) Calculation Result

The result is shown in Table 2.2-24. The flow capacity of each cross section exceeds the assumed maximum flow of 5,050 m3/s. Even if the maximum flow rate is discharged from the dam, it is apparent that the water level would hardly exceed the left bank levee height nor reach the bottom of the bridge beam.

Table 2.2-24 Calculation Result of Flow Capacity

Cross Section No	HWL	Verification of HWL	Cross Section Area A (m2)	Flow Velocity V (m/s)	Flow Capacity Q (m3/s)	Note
1	EL399.87	Left Bank (Project Side) Downstream of Existing Bridge Bank Height-0.5m	1572.4	5.385	8467.4	
2	EL400.93	Bridge Beam-0.5m	1500.0	5.251	7876.4	Existing Bridge Cross Section
3	EL400.15	Left Bank (Project Side) Upper stream of Existing Bridge Bank Height-0.5m	1518.7	5.187	7877.6	Planned New Bridge Cross Section (Beam Height EL401.92m)

2) Drainage Channel

Drainage channels flow down in a position lower than the road unlike irrigation channels. Excessive irrigation water and domestic wastewater flow into this drainage channels. Basically, excess water from the irrigation canal flows into the upstream end of the drainage channel, and the drainage has a relatively large cross section. Although the design discharge is defined for the main drainage, this is only for the excess water of irrigation. The current drainage capacity of the main drainage with drainage basin was calculated by Manning's formula as shown in Table 2.2-25.

Table 2.2-25 Flow Capacity of Each Crossing Drainage

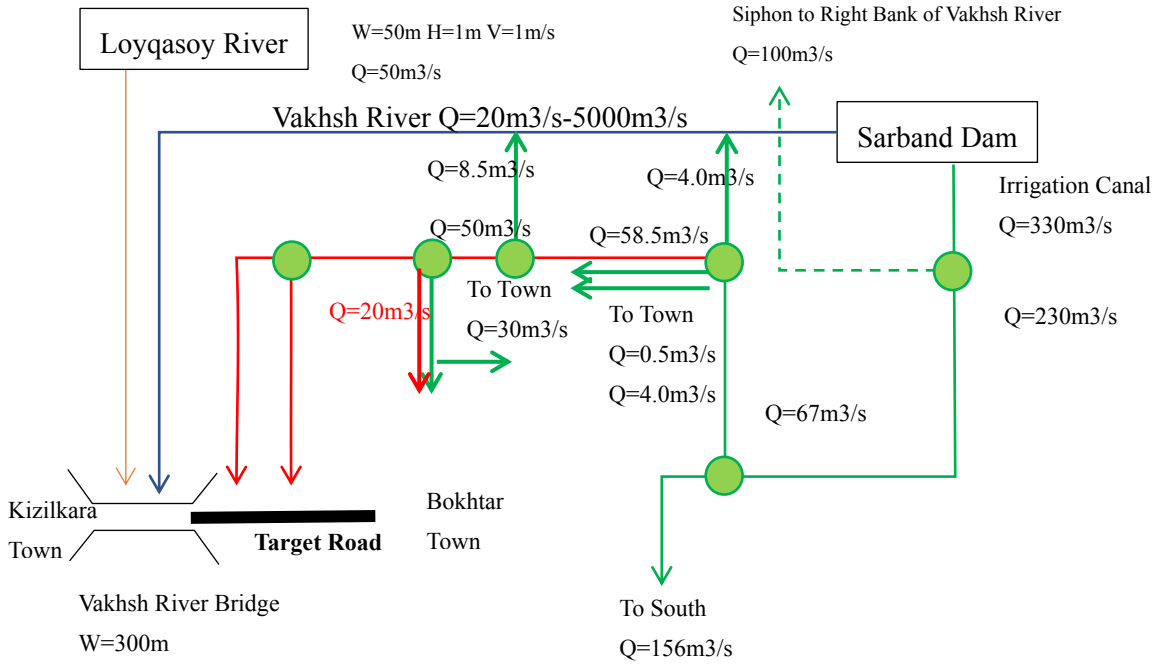
Kilo post	Classification	Flow Area A (m2)	Roughness Coefficient	Flow Velocity V (m/s)	**Flow Capacity** Q (m3/s)	Note
STA.742+54	Pipe Culvert	ϕ 1200	0.020	1.110	1.03	
STA.756+39	Pipe Culvert	ϕ 1000	0.020	0.980	2.00	
STA.780+33	Box Culvert	0.73	0.020	1.675	1.15	
STA.786+8	Bridge	16.0	0.025	3.695	59.1	No.15
STA.799+69	Box Culvert	0.40	0.020	2.460	0.98	
STA.805+4	Bridge	27.53	0.025	6.569	180.8	No.16

3) Irrigation Channel

Irrigation water is taken from the Sarband dam on the upper stream of the Vakhsh River, with repeatedly diversion and confluence, finally about 20 m3/s flows into the project site. Irrigation channels basically flow on the embankment and pipeline which is higher than the road height. Irrigation water is transported across roads by means of inverted siphons (bending the channel so that a part of the channel below the road runs underground). There are siphons traversing the project road at eight locations.

The Ministry of Melioration and Irrigation is in charge of the maintenance of the irrigation canal and the sluice gates.

The water-fed period is as shown in 2.2.4. Figure 2.2-46 shows the flow distribution map (approximate) of the main irrigation channels.



Red Character：Flow into Project Site

Figure 2.2-46　Main Irrigation Flow Distribution Map (approximate)

(2) Design Policy

1) Drainage Channel

The existing drainage cross pipes are aged and weak and the volume of the water is high. Therefore, it is desirable to replace the existing pipes instead of replenishing it. Irrigation canals will also be newly constructed instead of replacing as the only period the canals are not fed with water is for two days during the agricultural season and 4 months during the agricultural off- season (November to February) and casting of concrete during agricultural off-season, which lies in the winter season where the temperature plummets below zero, is not favorable.

The design policy is as follows.

- The size and capacity of the cross-drain structure will be equal to or superior than the existing structure. The size of the structure will be determined based on the analysis at the downstream side.
- For protection from traffic loads, pipe culverts require provision of full hunching foundation. In such case, the required concrete quantity and work volume is generally larger than box culverts of equivalent capacity. Therefore, box culverts shall be applied to all channels to be newly constructed.

- Damage on existing cross pipes are prominent at many locations. Such pipes are fundamentally subject to removal. However, where the pipes are not damaged, it will be filled with mortar to avoid influence on the road structure.
- In order not to modify the existing drainage system as much as possible, it is based on replacement at existing crossing position.
- Optimum structure for replacement of bridges No. 15 and No. 16 shall be determined through comparison between bridges and box culverts (detailed in 2.2.3.7).
- Drainage channels are fed with excessive irrigation water and domestic wastewater. Although the design discharge is defined for the main drainage, which only includes excessive irrigation water, and does not include outflow of rainfall from the basin. For this reason, it is necessary to set the drainage cross section size of the road crossing part (bridge or box culvert) as follows.

Design Discharge of Drainage = Design Discharge of Tajikistan (Excess Water of irrigation)
+ Rainfall Discharge from Drainage Basin

2) Irrigation Channel

The irrigation channels shall be designed at a new location and the structure type will be similar to the existing. The reason for designing at a new location is similar to the reasons given for drainage. The design policy is as follows.

- Since SNiP standards do not have design standards for agricultural siphons, Japanese standard is applied.
- Box culvert with equal capacity that of the existing will be newly provided with view to avoid influence on the distribution between the upstream and the downstream discharge. However, the capacity of the culvert will be checked based on the design conditions of the road and hydraulic analysis.

(3) Design Condition

1) Consideration of Calculation Method in ADB Project

In the report of ADB, the discharge is calculated using the method given in SNiP 2.01.14-83. Unlike the ADB section, the topography of the objective section is flat, so it is not necessary to consider debris flow. From this reason, it was found that the discharge calculated using SNiP method is extremely small. Therefore, the discharge shall be calculated with a rational formula commonly used in small catchment areas.

2) Applied Standard and Calculation Method

Channels are designed with the following standard / calculation method.

The return period of the drainage channel of the bridge No.15 and No.16 is 1/100-year return period in the ADB design. On the other hand, in the past JICA Grant Aid project (Kurgan Tyube - Dusty road Rehabilitation), the return period is 1/50 years. No.15 and No.16 drainages are minor rivers, and its' flow are artificially controllable on the upstream side. For that reason, applying 1/100 year return period will result into an over-optimistic design and is not justifiable to be implemented under the grant aid project. Therefore, 1/50 year return period is applied with view of the relevance as grant aid. The intensities of rainfall around Bokhtar City for 1/100 year and 1/50 year are 46.0 mm/h and 41.4 mm/h respectively.

Therefore, the return period of 1/10 year is applied for small-sized drainage channel, where the discharge is small and the structure is minor, and there is less risk of significant damage during flood, the return period. The rainfall intensity around Bokhtar City for 1/10 year return period is 30.4mm/h.

Table 2.2-26 Applied Standard and Calculation Method

Applied Standard	Calculation Method
Road Earth Work in Japan - Drainage Guideline - Culvert Guideline Ministry of Construction Ordinance for Structural Standard for River Administration Facilities	• Runoff Calculation by Rational Method • Setting Cross section by Manning's Formula • Bridge：1/50 year Return Period • Crossing Drainage Facilities：1/10year Return Period • Road Drainage Facilities：1/3 year Return Period

3) Calculation of Discharge

As mentioned above, the drainage channels are fed with excessive irrigation water and domestic wastewater. Although the design discharge is defined for the main drainage, which only includes excessive irrigation water, and does not include outflow of rainfall from the basin. For this reason, it is necessary to set the drainage cross section size of the road crossing part (bridge or box culvert) as follows.

Design Discharge of Drainage = Design Discharge of Tajikistan (Excess Water of irrigation)
+ Rainfall Discharge from Drainage Basin

The design discharges for drainage No. 2,5,6 and Bridge No.15 and 16 where water collects from the respective catchment area are calculated hereunder.

a) Calculation Method

The catchment areas of the rivers are less than 50 km2 and have no significant influence (storage phenomena) to the discharge. Therefore, a rational formula is used for the discharge calculation.

$$Q = \frac{1}{3.6} \cdot f \cdot R \cdot A$$

Q : Discharge(m3/s)
f : Runoff Coefficient
R : Average Rainfall Intensity(mm/hr.)
A : Catchment Area(km2)

b) Catchment Area

As mentioned above, the irrigation channel flows down at a high position, such as on the embankment, which is the drainage basin boundary. The runoff ratio is determined by land use as identified from aerial photographs.

The area of each catchment basin is shown in Figure 2.2-47.

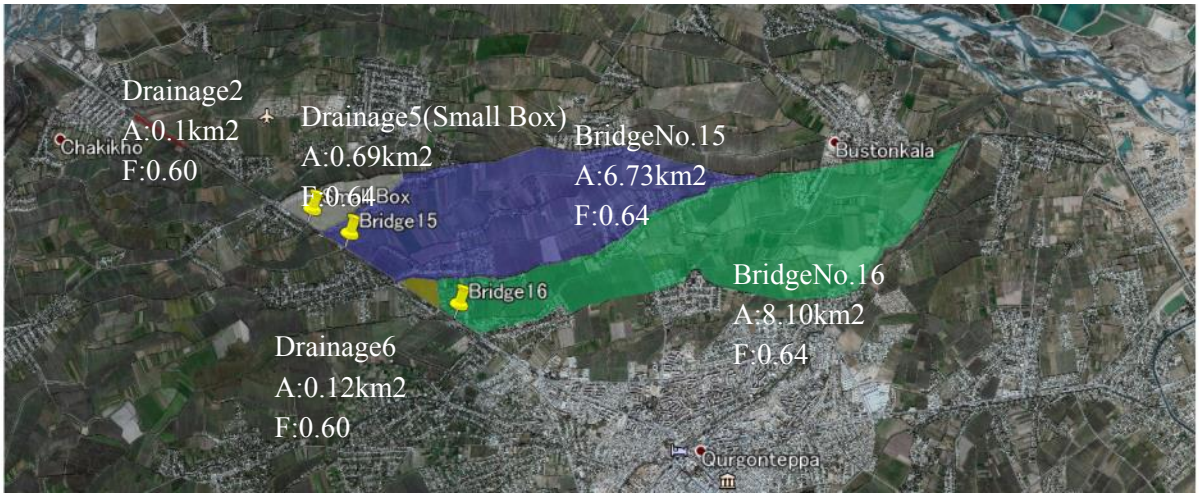


Figure 2.2-47 Catchment Area of Each Drainage Basin

c) Calculation Result of Discharge

The calculation results of the discharge are shown in Table 2.2-27. These calculation results are used as basic conditions of drainage design. The drainage cross section of the present condition satisfies the flow capacity except drainage No. 5.

Table 2.2-27 Calculation of Discharge

Kilo post	Channel	Design Discharge by Ministry① (m3/s)	Catchment Area (km2)	Return Period	Rainfall Intensity (mm/hr.)	Discharge from Basin ② (m3/s)	Design Discharge =①+② (m3/s)	Flow Capacity (m3/s)	Result of Flow Capacity	(Reference) SNiP Method (m3/s)
STA.742+54	Drainage1	0.25	0	1/10	30.4	0.00	0.25	1.03	OK	0.3
STA.756+39	Drainage2	N/A	0.10	1/10	30.4	0.51	0.51	2.00	OK	0.1
STA.780+33	Drainage5	1.20	0.69	1/10	30.4	3.72	4.92	1.15	NG	1.3
STA.786+8	Bridge15	5.00	6.73	1/50	41.4	49.53	54.53	59.12	OK	6.1
STA.799+69	Drainage6	N/A	0.12	1/10	30.4	0.61	0.61	0.98	OK	0.1
STA.805+4	Bridge16	5.50	8.10	1/50	41.4	58.68	64.18	180.85	OK	6.5

4) Cross Section of Drainage Channels

Table 2.2-28 summarizes the cross sections adopted in this design. The capacity of the inner section of the cross drainage channel was verified comparing to the design discharge calculated in the previous section and a required section was calculated. Drainage 3, 4, 7, and 8 are a small scale cross channel for road drainage and they are newly established in this design.

Gabion mat is provided for scour prevention at the inlet and outlet. Breast walls, open channels or a catchment basins are installed necessarily.

Table 2.2-28 Calculated Drainage Cross Section

Kilo post	Name	Existing Facility		Return Period	Slope (%)	Flow Capacity (m3/s)	Design Discharge (m3/s)	Required Cross Section (m)	Note
		Type	Size						
STA.742+54	Drainage1	Pipe Culvert	ϕ 1500	1/10	0.133	1.14	0.25	1.5×1.5	1.0×1.0 is OK, however keep existing size.
STA.756+39	Drainage2	Pipe Culvert	ϕ 1000	1/10	0.512	1.37	0.51	1.0×1.0	
STA.761+60	Drainage3	New			0.3		1.00	1.0×1.0	Small channel for road drainage
STA.767+20	Drainage4	New			0.3		1.00	1.0×1.0	Small channel for road drainage
STA.780+33	Drainage5	Box Culvert	1.1×0.8 m	1/10	0.729	5.03	4.92	1.6×1.6	
STA.799+69	Drainage6	Pipe Culvert	ϕ 1500	1/10	1.016	1.82	0.61	1.2×1.2	1.0×1.0 is OK, however keep existing size.
STA.820+00	Drainage7	New			0.3		1.00	1.0×1.0	Small channel for road drainage
STA.820+95	Drainage8	New			0.3		1.00	1.0×1.0	Small channel for road drainage

(4) Irrigation Channel Plan

1) Applied Standard

The design of irrigation channel is done by verifying the head loss and channel floor height with reference to the land reclamation design standards of Japan.

2) Design Discharge

a) Condition and Method of Calculation

As stated in the design policy, the structure applied is a box culvert. The dimension of the culvert was determined such that height difference between the inlet and the outlet is equal or larger than the hydraulic loss. The initial dimension considered for the calculation is 1.0 m × 1.0 m.

b) Verification

Table 2.2-29 shows the verification results. The dimensions of the culverts are based on the results of this calculation. Furthermore, the invert level of the inlet and outlet are basically unaltered from the levels of the existing but where necessary, catch basins are provided.

Table 2.2-29 Calculation of Siphon Specification

Kilo post	Name	Design Discharge by Ministry① (m3/s)	Existing Cross Section	Average Velocity (m/s)	Applied Cross Section (m)	Total Loss Head① (m)	Design Drop②(m)	Difference ②-①	Result
STA.747+70	1	1.20	φ1000	1.20	1.0×1.0	0.11	0.18	0.07	OK
STA.760+52	2	0.20	φ1000	0.20	1.0×1.0	0.00	0.31	0.31	OK
STA.764+73	3	0.30	φ1000	0.30	1.0×1.0	0.01	0.02	0.01	OK
STA.775+24	4	2.00	φ1800	0.89	1.5×1.5	0.06	0.22	0.16	OK
STA.782+63	5	0.40	φ1000	0.40	1.0×1.0	0.01	0.02	0.01	OK
STA.796+00	6	4.50	φ2000	2.00	1.5×1.5	0.31	0.46	0.15	OK
STA.802+60	7	0.12	φ1000	0.12	1.0×1.0	0.00	0.44	0.44	OK
STA.809+66	8	0.25	φ1000	0.25	1.0×1.0	0.00	0.24	0.24	OK

2.2.3.7 Bridge Plan

(1) Name of Objective Bridges

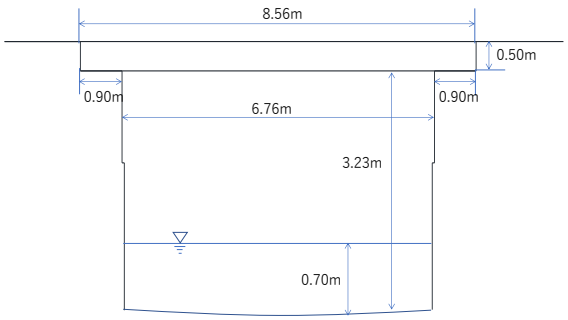
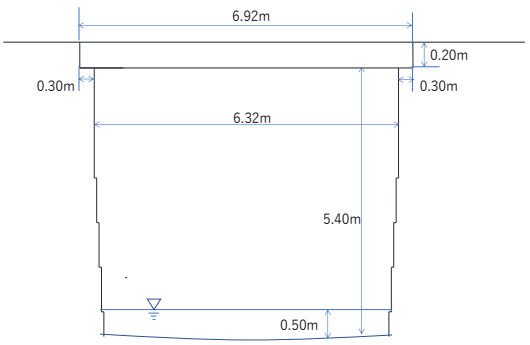
Objective bridges at STA.786+83and STA. 805+32 in the project road shall be named as No.15 bridge and No.16 bridge respectively, in continuity with the numbers adopted in the ADB section.

(2) Current Condition

Salient features of the existing bridges No.15 and No.16 are shown in Table 2.2-30. The bridges were constructed about 40 years ago. Cracks and spalling of concrete (exposing reinforced bars on bottom of the concrete deck) are seen in the both bridges.

Table 2.2-30 Geometric Element of the Existing Bridges

Name	STA.	Type of Bridge	Length	Width	Year of Completion	Load Limit
No.15 Bridge	786+83	Single span RC slab bridge	8.56m	8.85m (Carriageway) 1.0m (Sidewalk)	1980	30 ton
No.16 Bridge	805+32	Single span RC slab bridge	6.92m	8.95m (Carriageway) 1.0m (Sidewalk)	1980	30 ton

No.15 Bridge	No.16 Bridge
	
	

(3) Design Policy

The bridges are old and structurally weak and need to be reconstructed. The location of the bridges including the structural types to be adopted are determined following comparative study including design requirements and soil condition.

(4) Design Condition

1) Location

To avoid negative impact to the existing drainage system, the bridges are planned at the location of the existing bridges. This will contribute to minimize the construction cost also as altering the location will require provision of detours twice during the construction.

2) Design Condition

Conditions for the design of these bridges are as summarized in Table 2.2-31.

Table 2.2-31 Geometric Condition

Item		Applied	Remarks
Element	Number of lane	4	2 lanes on each side
	Carriageway width	3.5m	
	Median	3.0m	
	Shoulder	2.5m	
	Sidewalk	2.25m	
Overhead clearance from high water level		0.5m	SNiP
Required sectional area	No.15	W7.5×H2.8m	As mentioned in 2.3.6
	No.16	W7.8×H2.3m	

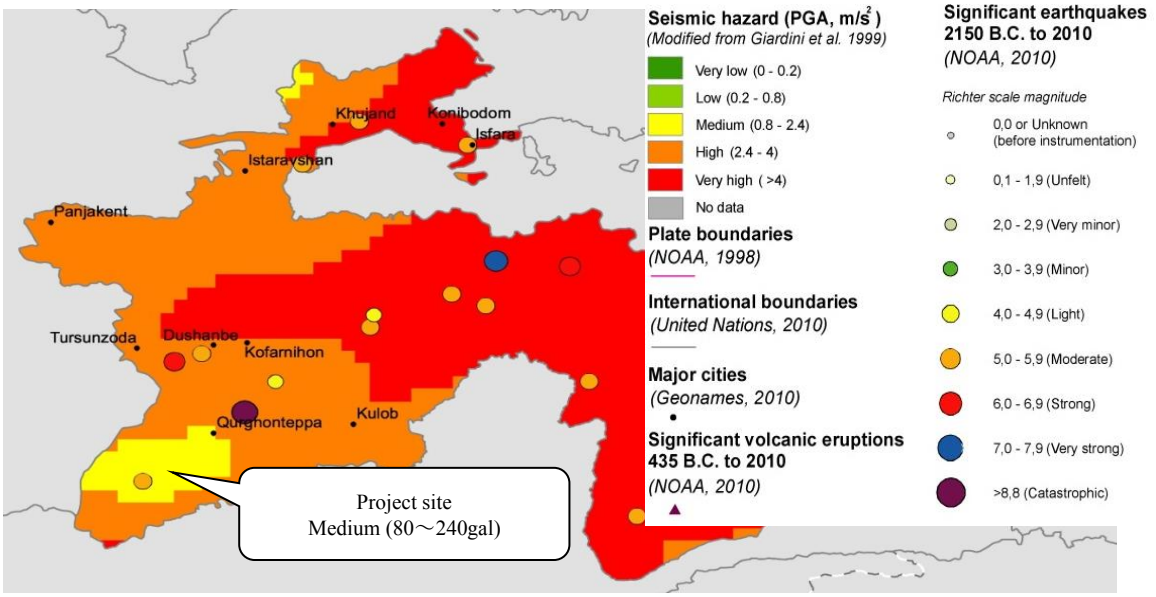
3) Design Load

NK-100, as stipulated in the SNiP and GOST and also applied for the design of Vaksh Bridge in the ADB section, which is given in Table 2.2-32 is applied.

The seismic hazard distribution map in Figure 2.2-48 indicates that the project area lies in the 'High Risk' zone, where the surface acceleration is expected in the range of 80-250 gal. Therefore, the design seismic coefficient 0.2 is considered with reference to the Japanese Standard.

Table 2.2-32 Load Condition

Item			Applied	Remarks
Live load	Load		NK-100	SNiP, GOST
		Total	980 kN (≒100 ton)	
		Axle load	245 kN (≒25 ton)	
		Wheel load	122.5 kN (≒12.5 ton)	
Seismic load	Design seismic coefficient		Kh0=0.2	



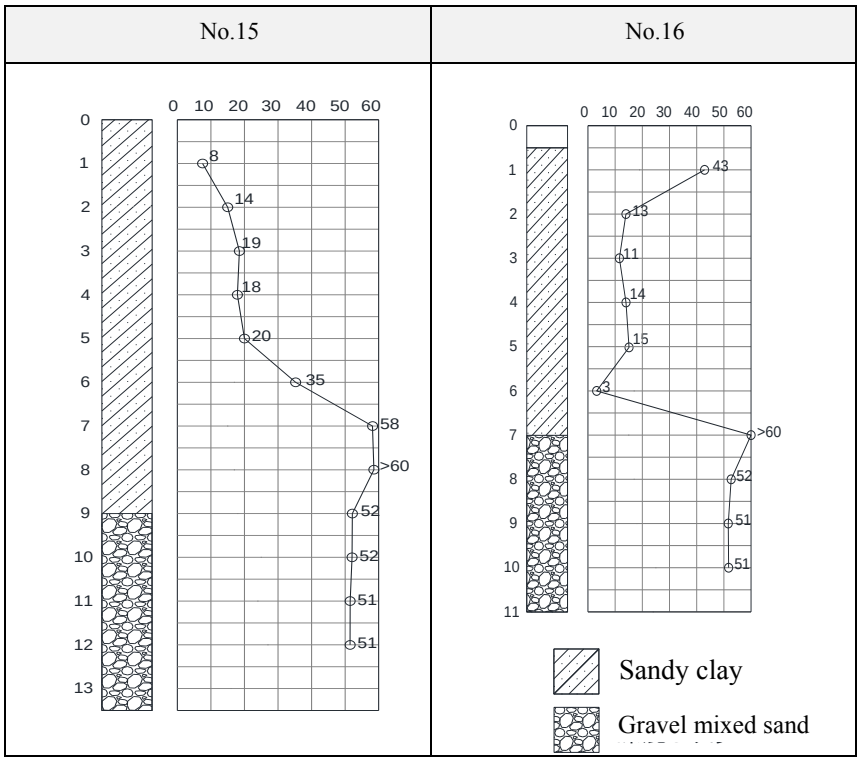
Source: WHO, Tajikistan: Seismic Hazard Distribution Map, 2010

Figure 2.2-48 Seismic Hazard Distribution Map

4) Ground Condition

Table 2.2-33 represents results of geo-technical investigation carried out under this project. The top layer is composed of gravel mixed clay. The thicknesses of the layer at No. 15 and No.16 are 9 m and 7 m respectively. Beyond these depths, the ground is composed of gravel mixed sand. The N-values are 50 or more with cohesion between 80 – 110 kN/m2 and internal friction angle between and 31.

Table 2.2-33 Boring Survey Result



(5) River Requirements

1) Freeboard

Freeboard height (height between high water level and the bottom of the top slab) of 0.5m is applied as stipulated in the SNiP for bridges where debris flow is not anticipated.

2) Design Discharge, High Water Level and Capacity

HWL and required cross sectional area were determined based on continuation of the crossing river and discharge capacity. The values for each bridge is as shown in Table 2.2-34.

Table 2.2-34 Required Cross Sectional Area

STA.	Name	Rain probability	Upstream HWL (EL.m)	Discharge capacity (m3/s)	Design Discharge (m3/s)	Required cross sectional area (m)	Applied cross sectional area (m)
STA.786+80	No.15	1/50	412.80	57.00	54.53	B7.5×H2.8	B7.5×H3.1
STA.805+40	No.16	1/50	415.85	66.71	64.18	B7.8×H2.3	B7.8×H4.6

3) Existing Pipe Culvert

A concrete pipe of 1000mm in diameter exists downstream No.15 bridge. The flow capacity of the pipe is significantly small creating a bottleneck (refer to Figure 2.2-49) and inundating the nearby area. It is therefore important that this culvert be replaced with a structure having equal of larger capacity than the bridge. This however is not included in the scope of this project due to budget constraint. It is thus recommended that the replacement of this culvert be undertaken by Tajikistan side within three years after completion of the Project .

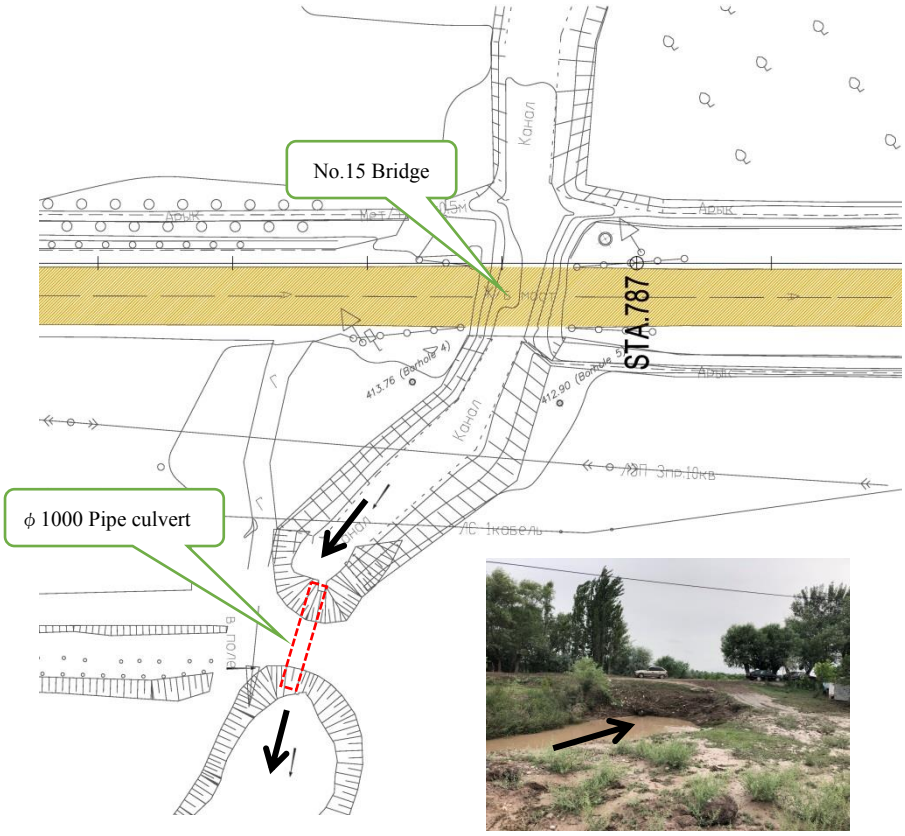


Figure 2.2-49 Existing Pipe Culvert Downstream at No.15

(6) Comparative Study of Structure Type

1) Alternative

Two types of structures, a bridge and a box culvert, are considered. The type to be adopted is determined based on the comparative study between the two types.

2) Comparison Result

Comparison result is summarized in Table 2.2-35 and Table 2.2-36. Box culvert was applied for both No15 and No.16 bridges.

(7) Box Culvert General Drawing

The general drawings of the box culverts are shown in Figure 2.2-50 and Figure 2.2-51.

Table 2.2-35 No.15 Structure Comparison

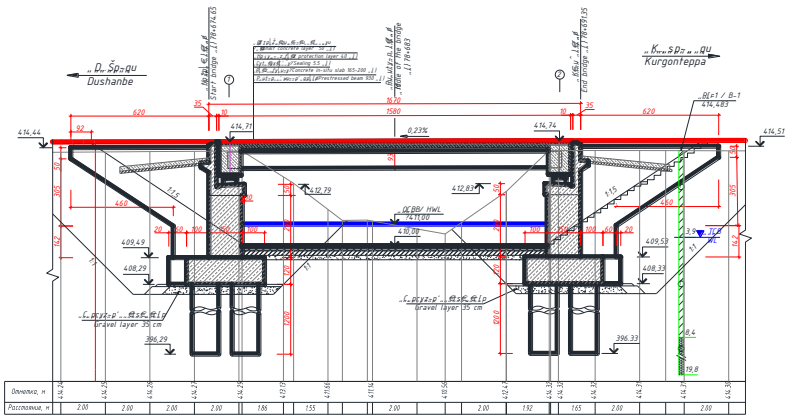
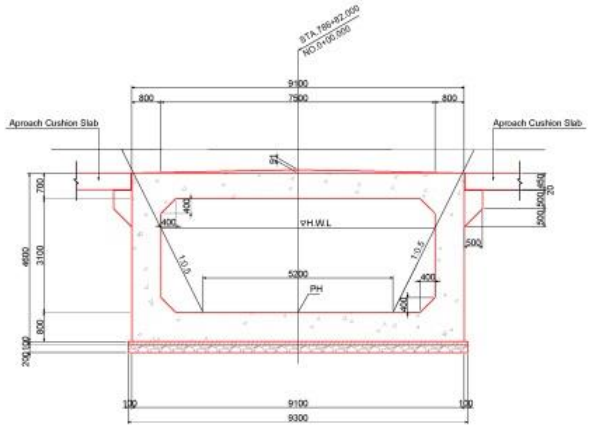
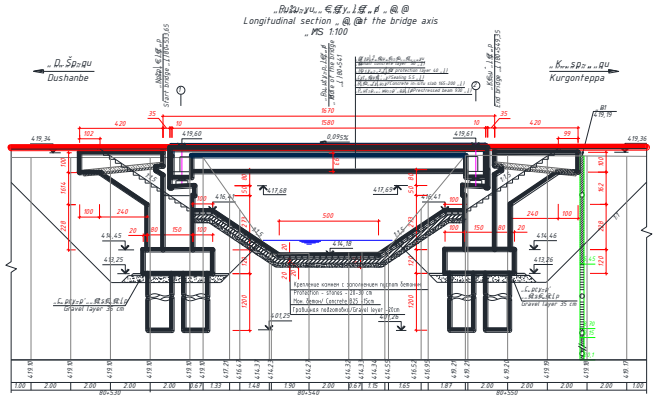
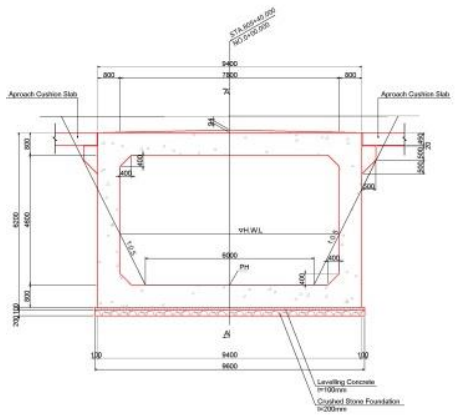
Alternative	Bridge		Box Culvert	
Outline				
Characteristics	■ Composed of Post-tension Concrete T-girder, Inverted T-shape abutment and pile foundation ■ Structurally stable due to short span	◎	■ Composed of top and bottom slab and side walls ■ Composite rigid structure ■ Excellent earthquake resistance	◎
Impact on river from structure	■ River depth is 0.5 m to 0.7 m in the ordinary condition. ■ Required cross sectional area can be secured. ■ River bed is under stable condition without scouring. Since scoring would be concentrated on abutment after installation of abutment, measures should be taken.	○	■ River depth is 0.5 m to 0.7 m in the ordinary condition. ■ Required cross sectional area can be secured. ■ Although river bed is fixed by installing concrete slab, there is not particularly any problem in water flowing	○
Workability	■ Installation of pile foundation and abutment takes longer time than box culver. ■ Construction work needs to be stopped temporarily during winter.	△	■ Since it does not have piles, construction is easier and faster.	◎
Cost	High (Ratio: 1.0)	△	Low (Ratio: 0.5)	◎
Maintenance	■ Since ancillaries such as expansion joint or bearing are required, and they would be weak points of bridge structure, specific inspection and maintenance technology and equipment are necessary. ■ Repair work is more complicated than box culvert.	△	■ Weak points are relatively less than bridge due to rectangularly connected simple structure without ancillaries. ■ Visual inspection can be effectively made ■ Maintenance and repair are easier than bridge.	◎
Evaluation	○		◎ **Applied**	

Table 2.2-36 No.16 Structure Comparison

Alternative	Bridge		Box Culvert	
Outline				
Characteristics	■ Composed of Post-tension Concrete T-girder, Inverted T-shape abutment and pile foundation ■ Structurally stable due to short span	◎	■ Composed of top and bottom slab and side walls ■ Composite rigid structure ■ Excellent earthquake resistance	◎
Impact on river from structure	■ River depth is 0.5 m to 0.7 m in the ordinary condition. ■ Required cross sectional area can be secured. ■ River bed is under stable condition without scouring. Since scoring would be concentrated on abutment after installation of abutment, measures should be taken.	○	■ River depth is 0.5 m to 0.7 m in the ordinary condition. ■ Required cross sectional area can be secured. ■ Although river bed is fixed by installing concrete slab, there is not particularly any problem in water flowing	○
Workability	■ Installation of pile foundation and abutment takes longer time than box culver. ■ Construction work needs to be stopped temporarily during winter.	△	■ Since it does not have piles, construction is easier and faster.	◎
Cost	High (Ratio: 1.0)	△	Low (Ratio: 0.5)	◎
Maintenance	■ Since ancillaries such as expansion joint or bearing are required, and they would be weak points of bridge structure, specific inspection and maintenance technology and equipment are necessary. ■ Repair work is more complicated than box culvert.	△	■ Weak points are relatively less than bridge due to rectangularly connected simple structure without ancillaries. ■ Visual inspection can be effectively made ■ Maintenance and repair are easier than bridge.	◎
Evaluation	○		◎ **Applied**	

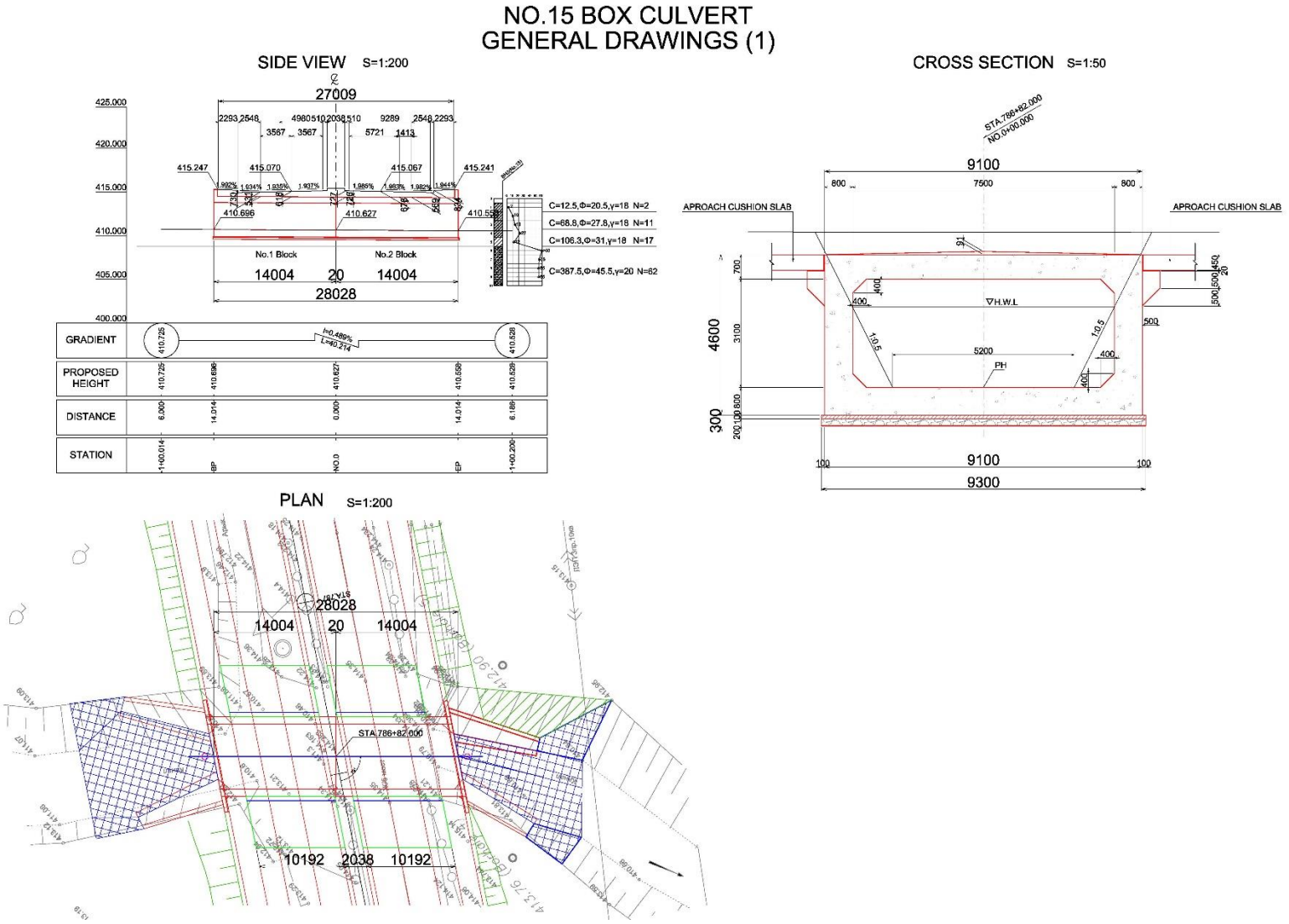


Figure 2.2-50 No.15 Box Culvert General Drawing

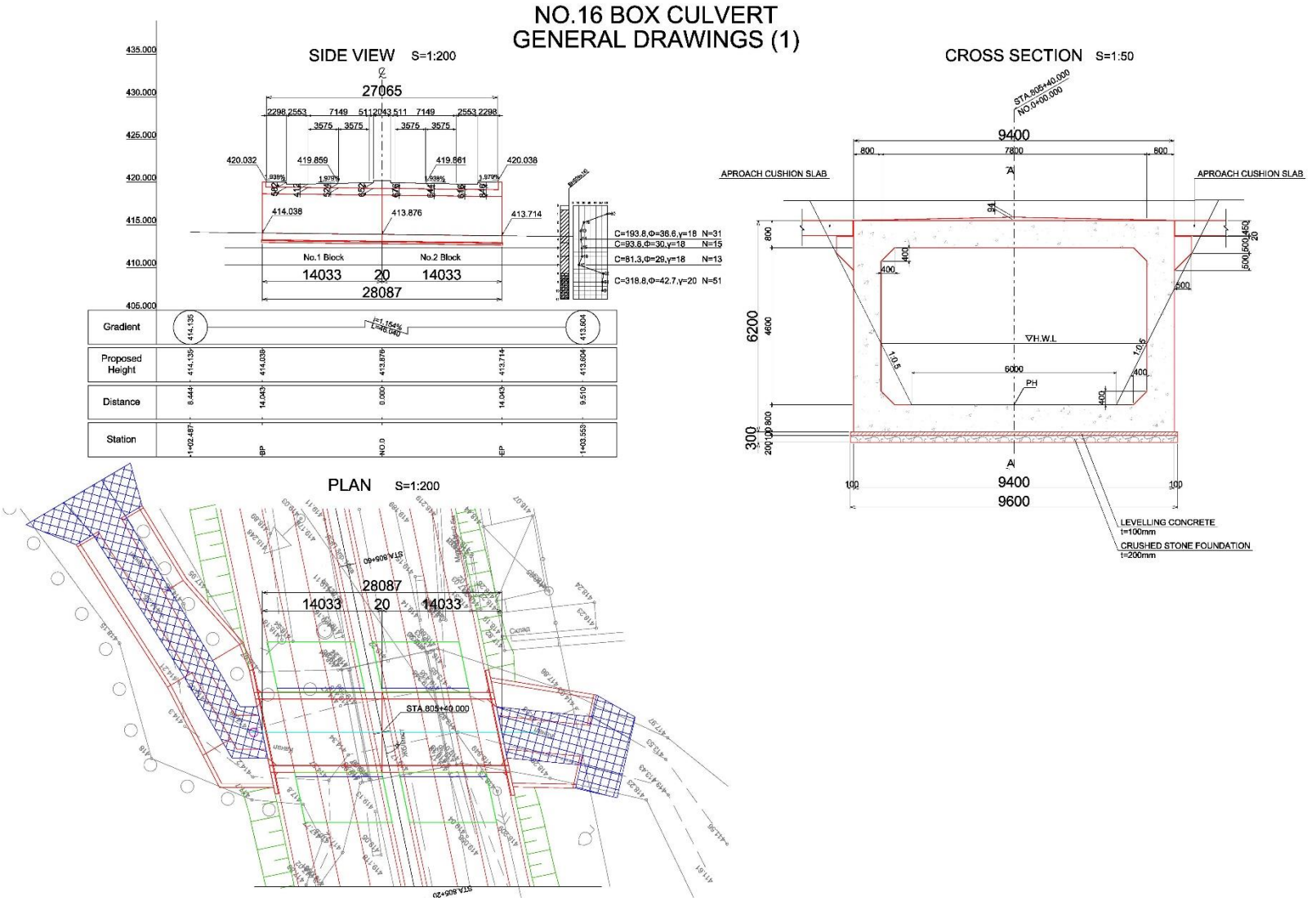


Figure 2.2-51 No.16 Box Culvert General Drawing

2.2.3.8 Traffic Safety Facility Plan

(1) Design Policy

Traffic safety facilities were designed based on the policies shown in Table 2.2-37.

Table 2.2-37 Design Policy on Traffic Safety Facility

No.	Items	Policy
1	Design speed	● Design speed: 100km/h ● Restricted speed: 60km/h (generally applied in the urban section)
2	Cross section element (Shoulder and sidewalk)	● Installation of 2.5m wide shoulder ● Consistency with ADB section ● Installation of 2.25m sidewalk
3	Median strip	● Physically divided by strip or concrete barrier
4	Intersection improvement (Installation of exclusive lane for left and right turn, zebra crossing and traffic signal)	● At-grade type applied ● Installation of auxiliary lane ● Installation of intersection
5	U-turn lane	● Installed at two locations
6	Speed reduction facility	● Installation of road marking and regulatory sign before the intersection
7	Pedestrian guardrail	● Installed at the section where embankment height is 3m or higher
8	Traffic safety facility during night time	● Installed in the zebra crossing and intersection ● Installation of reflective road studs on the median strip and kerb stone

(2) Road Marking for Speed Reduction

1) Outline

Figure 2.2-52 shows outline of road marking for speed reduction that is commonly used in Japan.

Figure 2.2-52 Road Marking for Speed Reduction

2) Function and Effectiveness

These road markings are effective visually and psychological to raise awareness to drivers to reduce speed. This measure is easy to be taken and reasonable as it needs only marking on the road surface.

3) Provision Locations

Road markings for speed reduction are planned at 50 m before and at 50m interval as shown in Figure 2.2-53.

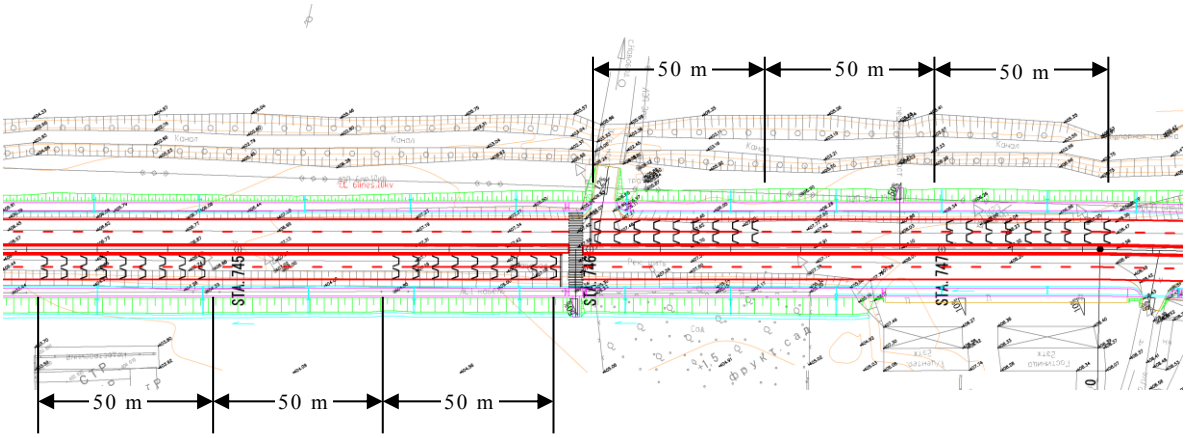


Figure 2.2-53 Installed Location of the Road Marking

(3) Regulatory Signs

Regulatory signs are planned in accordance with SNiP and GOST. It will be installed along the entire objective section.

(4) Reflective Road Studs

1) Outline

Reflective road stud is a 10 cm square-shaped reflective plate with a height of 1.8 cm. Provision of this contributes to enhancing traffic safety during night time as it indicates the edges of the travelled way to drivers. Figure 2.2-54 presents the image of the studs planned to be provided.

Figure 2.2-54 Image of Reflective Road Studs

2) Function and Effectiveness

The studs help enhance traffic safety during night time as it glows in response to the lights. (refer to the left picture in Figure 2.2-54). This contributes in increasing the visibility of the driver and providing accurate information of the travelled way.

3) Provision Locations

The reflective road studs are planned to be fixed on the kerb of median strip and/or sidewalk in an interval of 10 m interval in the sections where no street lights are.

(5) Shoulder Rumble Strips

1) Outline

Widened shoulder is expected to serve for multi-purpose vehicles (slow vehicles, animal-driven vehicles). Therefore, it is preferable to separate the carriageway and the shoulder so that fatal accidents between through vehicle and slow speed vehicle taking shoulder or pedestrian can be prevented. Although edge line is provided, it does not function during night time. Therefore, in addition to the road marking, rumble strips are planned (Figure 2.2-55 presents an image of the rumble strips planned) along the shoulder.

Figure 2.2-55 Shoulder Rumble Strips

2) Function and Effectiveness

Shoulder rumble strips are longitudinal rumble strips made by scooping the pavement outside of the edge line. Rumble strips help notify drivers travelling the roadway when they accidentally cross the edge line as running over it produces sound and vibration. It is also effective during winter when the road is accumulated by snow.

Shoulder rumble strips have been proven to be very effective method to warn drivers that they are about to drive off the road. Many studies show very high benefit-to-cost (B/C) ratios for shoulder rumble strips, making them among the most cost-effective safety features available.

3) Provision Locations

Shoulder rumble strip are planned along the shoulder on both directions.

(6) Pedestrian Guardrails

1) Outline

In accordance with GOST, pedestrian guardrails were planned as illustrated in Figure 2.2-56.

2) Purpose and Effectiveness

Pedestrian guardrails s are provided for preventing pedestrians from accidentally falling down.

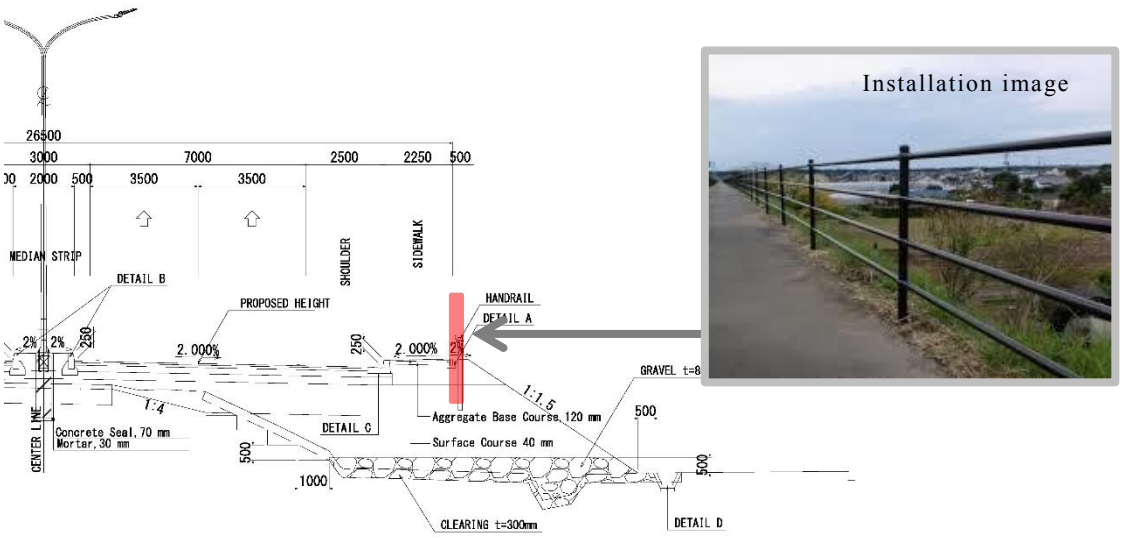


Figure 2.2-56 Pedestrian Guardrails

3) Provision Locations

Pedestrian guardrails are planned along sections where embankment height is 3 m or higher.

2.2.3.9 Traffic Signal Plan

(1) Target Intersection

As noted in 2.2.3.3, the target intersections are Intersection-01 (STA.774+60) and Intersection-02 (STA.820).

(2) Design Policy and Condition

Traffic signals are planned to be procured locally so that its maintenance is possible to be done by MOT. Also, the signals are planned in accordance with the requirements of GOST.

Layout of signals was determined based on analysis result as explained in 2.3.3.

(3) Plan

1) Signal Devices

Standard type commonly used in Tajikistan and shown in Figure 2.2-57 is adopted.

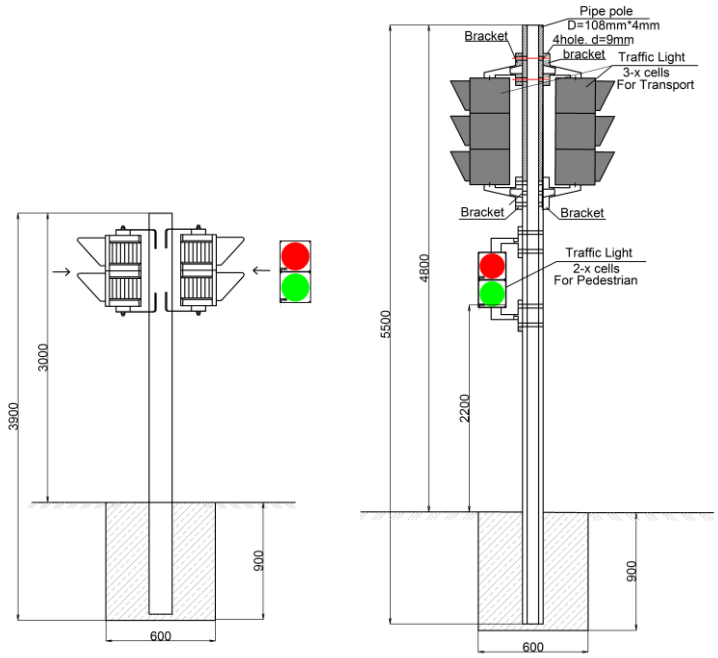


Figure 2.2-57 Signal Device

2) Layout Plan

Figure 2.2-58 to Figure 2.2-60 shows layout plans of the intersection-01 and 02.

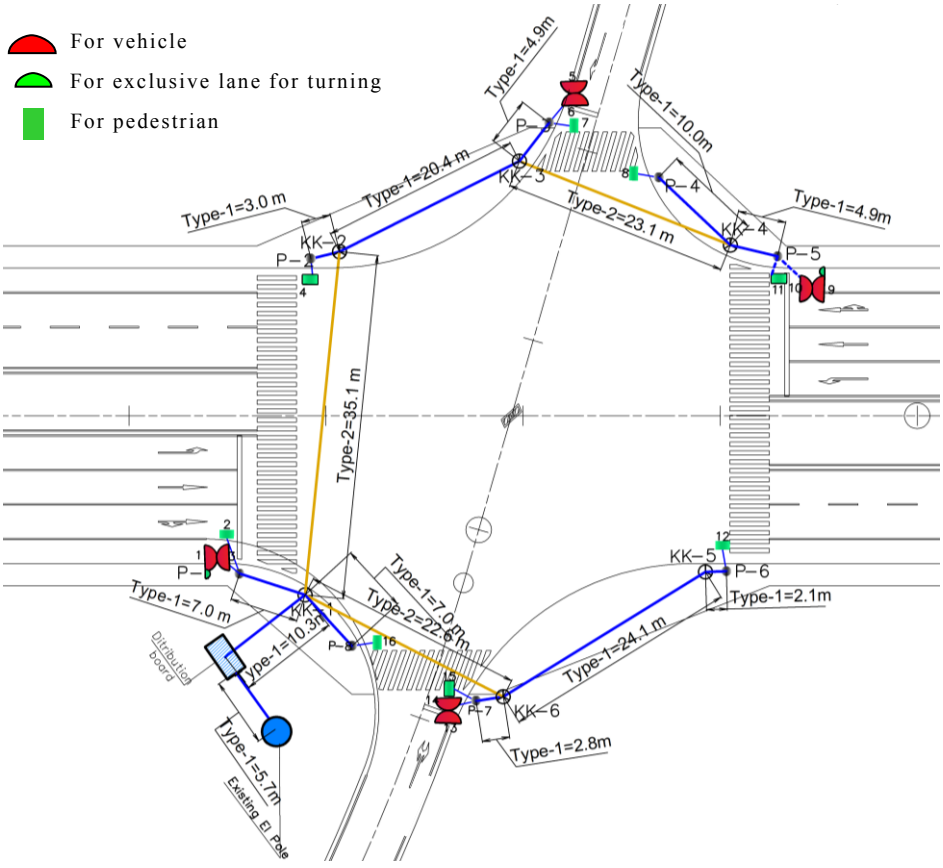


Figure 2.2-58 Intersection-01 (STA.774+60)

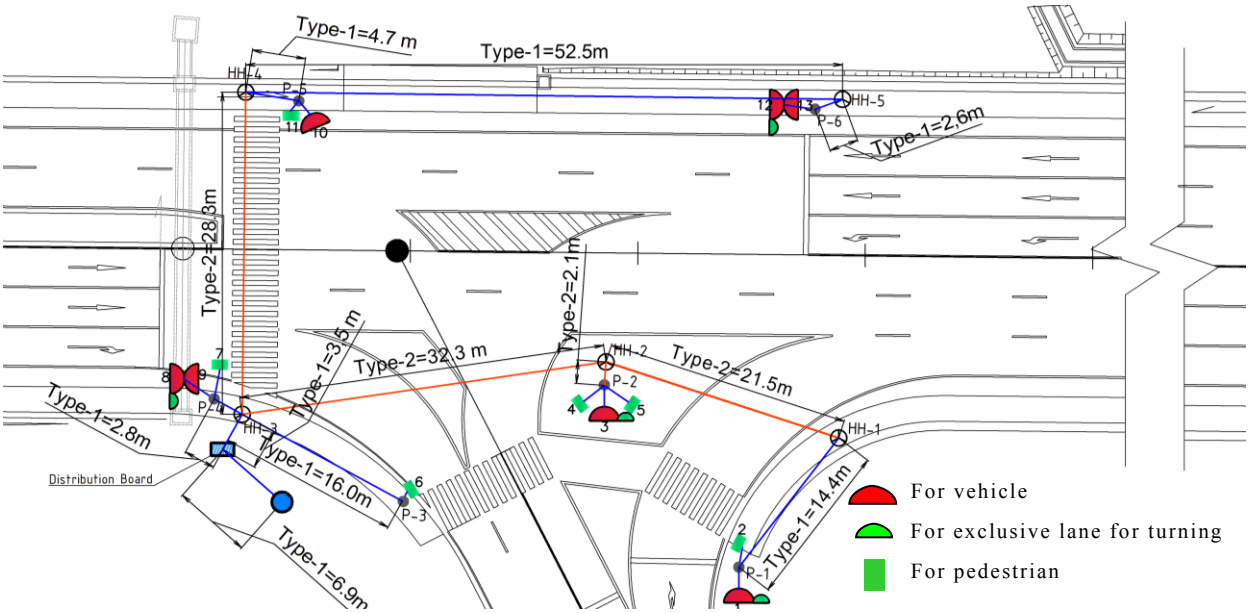


Figure 2.2-59 Interesection-02 (STA.820) [1/2]

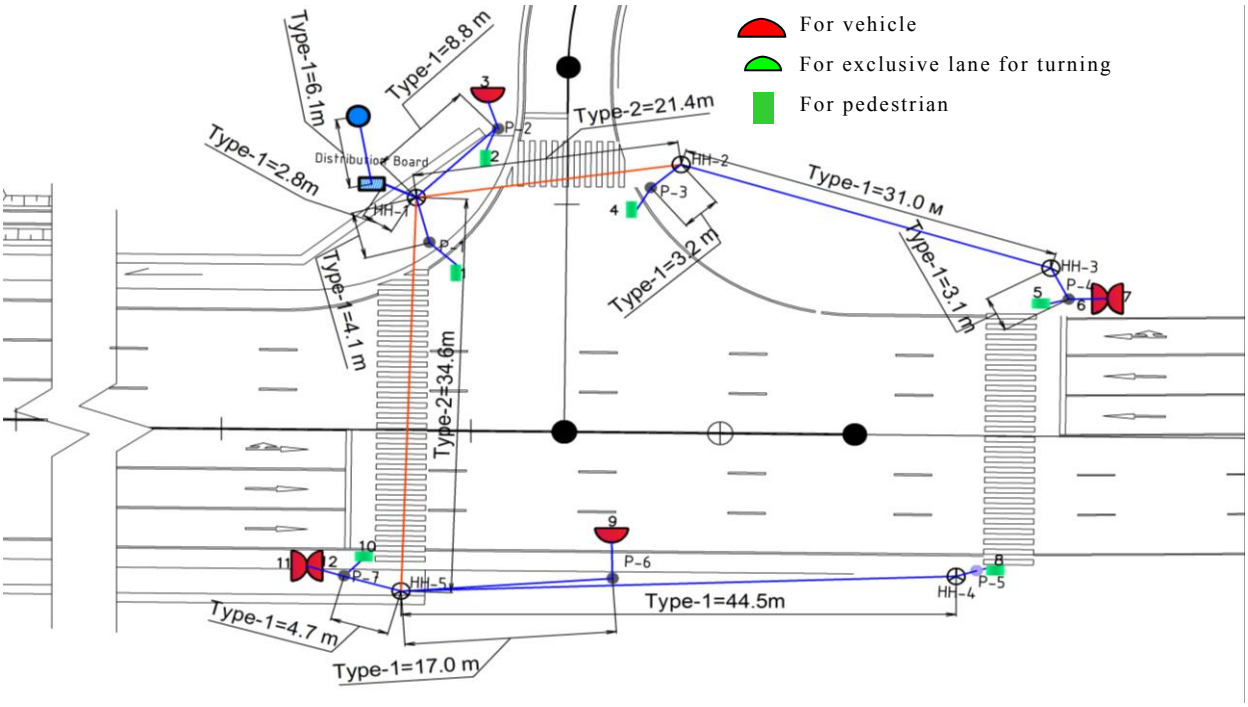


Figure 2.2-60 Interesection-02 (STA.820) [2/2]

2.2.3.10 Street Lights

(1) Design Policy

Design policy is as follows.

- Local procurement of the material considering budgetary aspect
- Application of LED type for lamps considering durability
- Design will be based on Japanese standard but verified with SNiP and GOST
- Provision is planned at intersections and near zebra crossings

(2) Design Condition

1) Comparison of Japanese Standard with SNiP/GOST

Comparison result between Japanese standard and SNiP/GOST in street light design is shown in Table 2.2-38. From the table, it is apparent that the Japanese standard meets SNiP/GOST requirement.

Table 2.2-38 Design Condition

Item	Japanese Standard		Tajik Standard	Remarks
Standard	Lighting Installation Standard, MLIT, Japan	LED Installation Guideline, Japan	SNiP 52.13330.2011	Considered as 2 lanes a 1 direction
Specification	Type C (For national Highways /collector roads)	Type k	Class: B3	Design speed shall be 60km/h
Minimum road surface luminance	0.5 cd/m2		0.4 cd/m2	
Luminance uniformity	0.5		0.4	
Illuminance	10 lx		6 lx	

(3) Installed Structure Type, Position and Location

As shown in Figure 2.2-61, there are single armed and double armed street lights. The former is provided at the road edge while the latter at the median. Street lights are provided at intersections and near zebra crossings, as aforementioned.

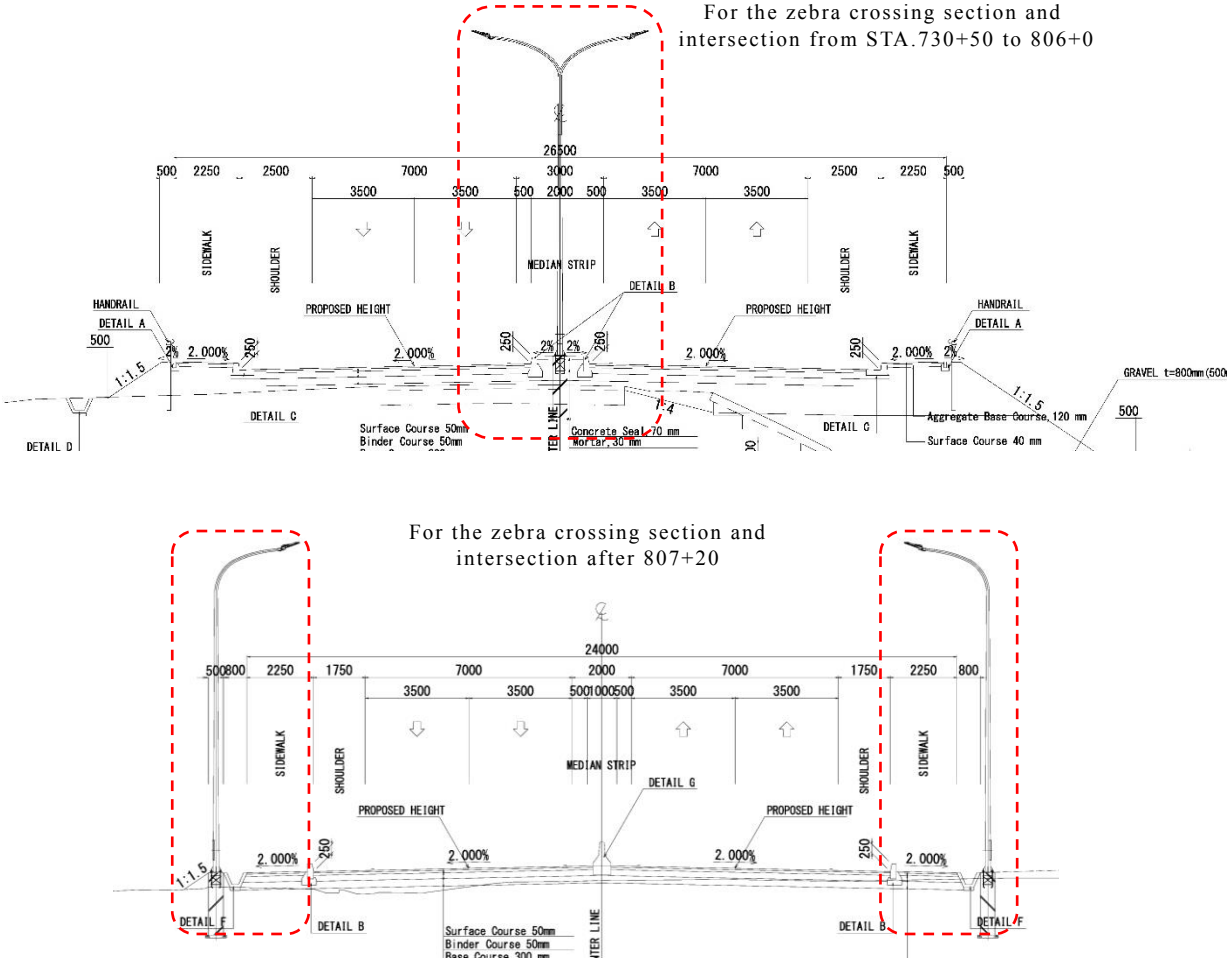


Figure 2.2-61 Installed Structure Type, Position and Location

2.2.3.11 Sidewalk, Access Road and Access

(1) Design Policy

Side walk is provided at both sides along the entire stretch of the objective road. Access road and access to abutting properties similar to the existing ones are planned.

(2) Pavement Structure

1) Sidewalk

4 cm asphalt concrete for wearing course and 12 cm crushed stone for basecourse shall be planned, which is similar to the pavement composition adopted in the ADB section.

2) Access Road

Pavement composition for access roads will have 5cm asphalt concrete wearing course and 15cm crushed stone base course in accordance with the composition mentioned in the general standard of Japan for access roads having an average daily traffic volume less than 250.

3) Access

Pavement composition for accesses (abutting properties such as houses, restaurants, gas stations etc.) will have 5 cm asphalt concrete for wearing course and 25 cm crushed stone for basecourse. For accesses used by heavy vehicles, 25 cm cement concrete for wearing course and 25 cm crushed stone for base course are be planned.

2.2.3.12 Other Structures

(1) Type of Structures and Design Policy

Type of other structures and design policies applied are shown in Table 2.2-39.

Table 2.2-39 Type of Other Structures and Design Policies

Structure	Design Policy
Retaining Wall	• Gravity wall shall be applied. • It aims at adjusting difference in height to the existing ground level
Bus Bay	• It shall be installed at existing bus bays nearby • Concrete pavement shall be applied to prevent plastic deformation of pavement surface from loading of heavy vehicle
Revetment	• It shall be planned for 10 m length downstream and upstream at No.15 and No.16 box culvert • Protected by leaning wall with 1:0.5 slope gradient • Gabion shall be planned in transition area between revetment and the existing river bank to prevent from scoring

(2) Retaining Wall

1) Installed Location

For adjusting difference in height between the planned road level and the existing ground level, gravity walls at three locations are planned (Figure 2.2-62).

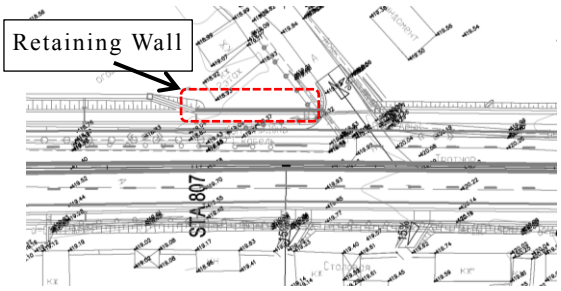


Figure 2.2-62 Outline of Installing Retaining Wall

2) Structure

The gravity type which is advantageous to the budgetary aspect and workability was applied.

(3) Bus Bay

1) Outline

Bus bay as shown in Figure 2.2-63 was planned near or at the existing bus bays.

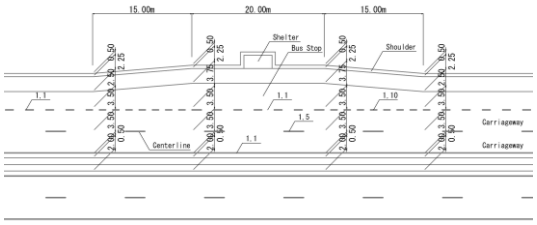


Figure 2.2-63 Bus Bay

2) Pavement Structure

As mentioned in the design policy, Concrete pavement was applied to prevent plastic deformation of pavement surface from loading of heavy vehicle.

(4) Revetment

1) Outline

In order to protect the structure itself of the No.15 and No.16 box culvert and river bank, revetment was planned by installing leaning wall.

2) Design Policy

a) Protected Zone

- It shall be installed for 10 m in the both upstream and downstream direction in accordance with Japanese standard.
- 1:0.5 of slope gradient shall be applied considering topographic condition.
- 50 cm depth of embedment from the existing river bed level and the gabion being 0.5 cm height, 1.0 m width and 2.0 m long shall be installed.

b) Transition Zone

- 10 m Transition zone from the protected zone to the existing river bank in the both upstream and downstream shall be set.
- The gabion being 0.5 cm height, 1.0 m width and 2.0 m long shall be installed.
- Suction preventive sheet was planned at grounding plane.

2.2.4 Outline Design Drawing

2.2.4.1 Table of Contents of Outline Design

Table of contents of outline design drawing is shown in Table 2.2-40. The drawings are attached in Appendix 3.

Table 2.2-40 Table of Contents of Outline Design

No.	DRAWING TITLE
1	PLAN
2	PROFILE
3	TYPICAL CROSS SECTION
4	INTERSECTION PLAN
5	PAVEMENT
6	NO.15 BOX CULVERT
7	NO.16 BOX CULVERT
8	CROSS DRAINAGE BOX CULVERT
9	SIPHON TYPE BOX CULVERT FOR IRRIGATION
10	REVETMENT
11	GRAVITY WALL
12	ROAD ANCILLARIES
13	STREET LIGHT
14	TRAFFIC SIGNAL
15	DRAWINGS OF SECONDARY ROAD

2.2.4.2 Items to be Undertaken at Detail Design Stage

(1) Additional Boring Survey at No.16

The JICA survey team initially conducted the boring survey at the location 160 m away from the existing bridge based on the Bokhtar City urban development plan. However, after discussion with Bokhtar City, it was agreed that the new box culvert will be installed at the same location as the existing one. Therefore, additional boring survey shall be done at D/D stage to confirm the soil property.

(2) Shape of Intersection at STA.822

After discussion with MOT and Bokhtar City, traffic operation under the same current condition at small intersection at STA.822 was requested. At D/D stage, this issue shall be considered through further site survey and discussion.

(3) Securing of Space for Future Use by Installation of Underground Structures

In Bokhtar urban development plan, it was planned to develop along the project road by constructing high buildings and public facilities. At the discussion, Bokhtar City requested to secure space for future use such as water pipes or communication cables, by installation of underground structures. Given that the cross structures will be installed during construction stage, there is no need to demolish the project road. Therefore, this issue shall be considered through further site survey and discussion.

(4) Traffic Simulation

When in technical meeting with the Team and MOT held in November 2018, MOT requested the Team to conduct traffic simulation for the Intersection-02 so that MOT can give the traffic police an explanation on traffic safety even if the traffic signal operation is applied. Possibility of conducting the simulation shall be studied at D/D stage.

(5) Bicycle Lane Marking

As well as the traffic simulation mentioned above, MOT requested to add road marking for bicycle lane as shown in Figure 2.2-64. This request shall be reflected at D/D stage.

Figure 2.2-64 Bicycle Lane Marking

2.2.5 Implementation Plan

2.2.5.1 Implementation Policies

- This project will be implemented under the Grant Aid Scheme of the Government of Japan (GOJ) in accordance with the Grant Agreement (G/A) and the Exchange of Notes (E/N) between the Republic of Tajikistan and the GOJ.
- The executing agency for the implementation of the project is the Ministry of Transport (MOT) of the Republic of Tajikistan.
- The consulting services including detailed design, tender-related works and construction supervision services, will be provided by a Japanese consulting firm in accordance with the consultancy contract that shall be signed with the Republic of Tajikistan.
- The construction of the project will be executed by a Japanese construction firm that shall be selected through pre-qualification and bidding, in accordance with the construction work contract that shall be signed between the said construction firm and the Republic of Tajikistan.
- The basic policies for the construction/procurement of this project are as follows:
  i) The equipment, materials and labor for construction shall be, to the possible extent, procured locally. In cases where local procurement is not possible, they shall be procured either from a third country or from Japan where it is most economical provided the required quality and supply quantity are secured.
  ii) Construction methods and the construction processes shall be consistent with the local climate, topography, geology and natural conditions including the characteristics of nearby rivers.
  iii) Plan a general and easy construction method which shall not require the use of special or sophisticated equipment or technology.
  iv) The contractor's site organization shall be planned to satisfy the established construction specifications and construction management standards set for this project. Likewise, the consultant's organization shall be based on such specified project management standards.
  v) To ensure safety during construction, an appropriate traffic management plan including deployment of traffic personnel at vantage positions shall be considered.
  vi) In order to reduce the influence of construction works on of the environment of project site, appropriate preservation methods of the environment, such as the selection of temporary garbage dumping sites which were specified from the Republic of Tajikistan shall be adopted.

2.2.5.2 Implementation Condition

(1) Natural Condition

Since air temperature becomes sometimes -2 degree during winter season, it should be carefully considered for paving asphalt concrete and casting cement concrete.

(2) Points to Be Considered during Implementation

Travel speed during construction shall be 40 km/h or more. When in construction of the road, split construction work method shall be adopted securing the number of the existing traffic lanes so that exiting traffic is not disrupted.

(3) Detour Plan and Step-wise Construction

Figure 2.2-65 shows the step-wise detour plan at the construction site of the crossing drainages.

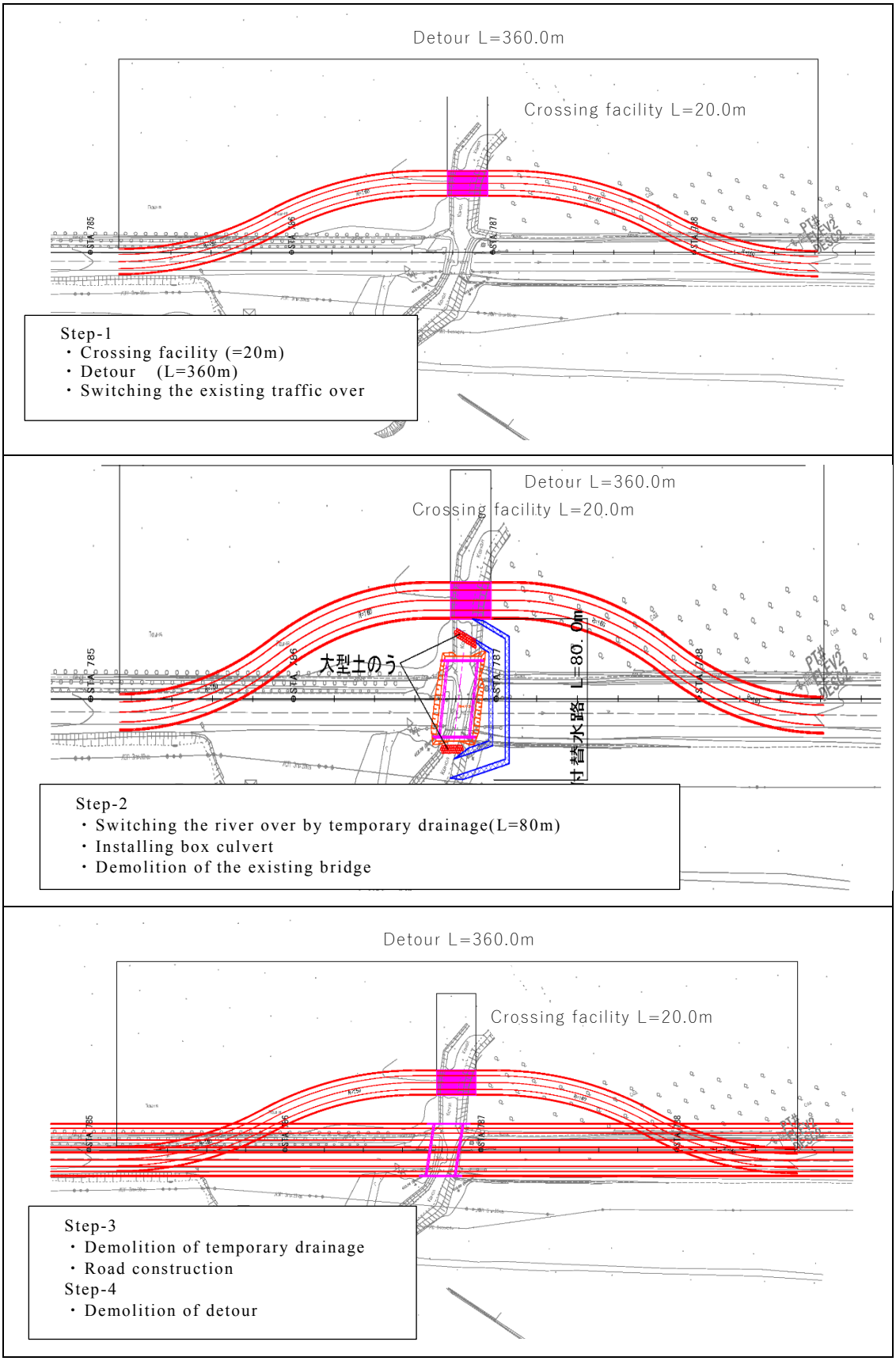
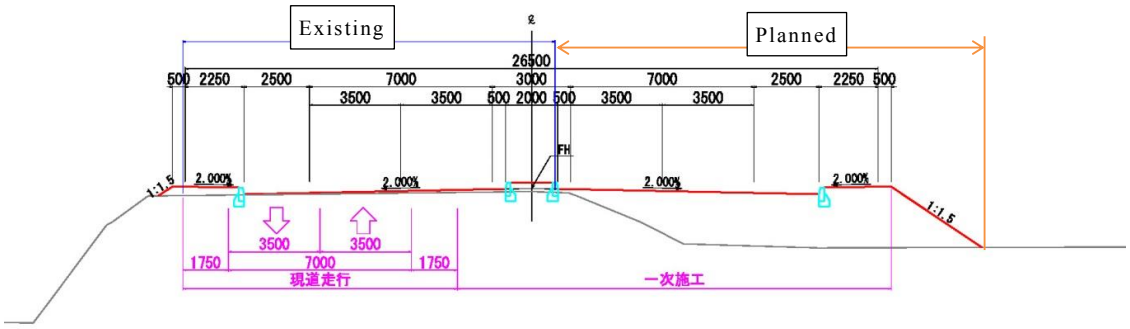


Figure 2.2-65 Detour Plan and Step-wise Construction

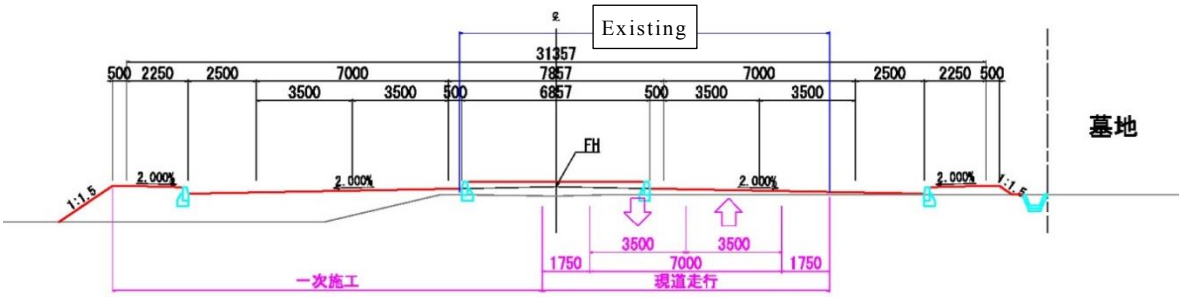
Concept of the two step-wise construction for standard section, U-turn section and Bokhtar section is shown in Figure 2.2-66 and Figure 2.2-67.

First Step

Standard Section



U-Turn Section (①STA.736+00-STA.739+94, ②STA.799+86-STA.805+20)



Bokhtar Section (STA.807+20-End Point)

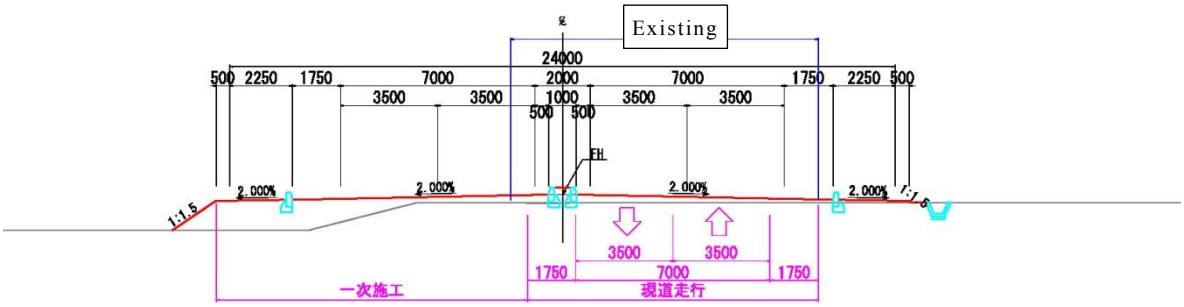
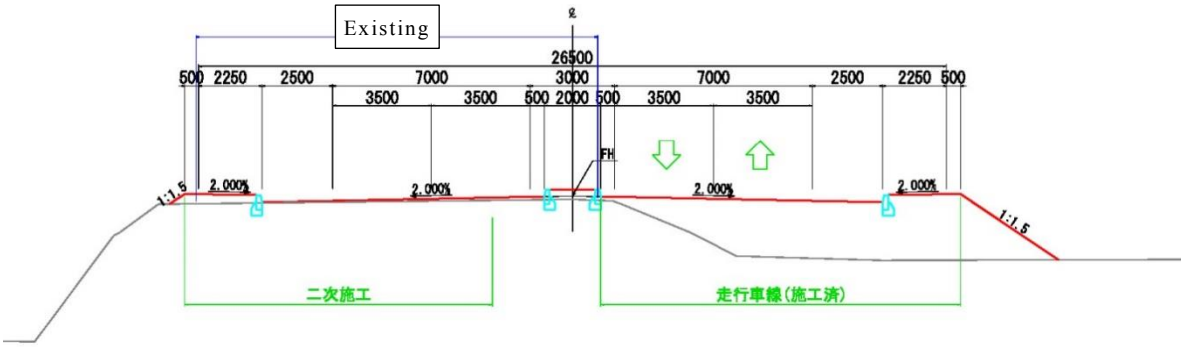


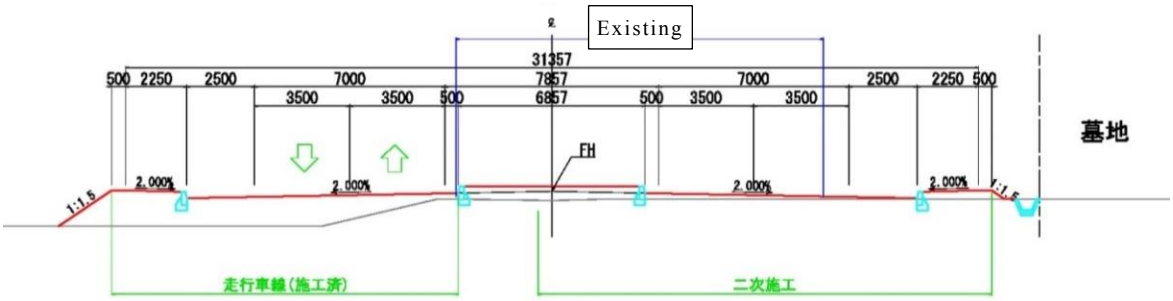
Figure 2.2-66 First Step Construction

Second Step

Standard Section



U-Turn Section (①STA.736+00-STA.739+94, ②STA.799+86-STA.805+20)



Bokhtar Section (STA.807+20-End Point)

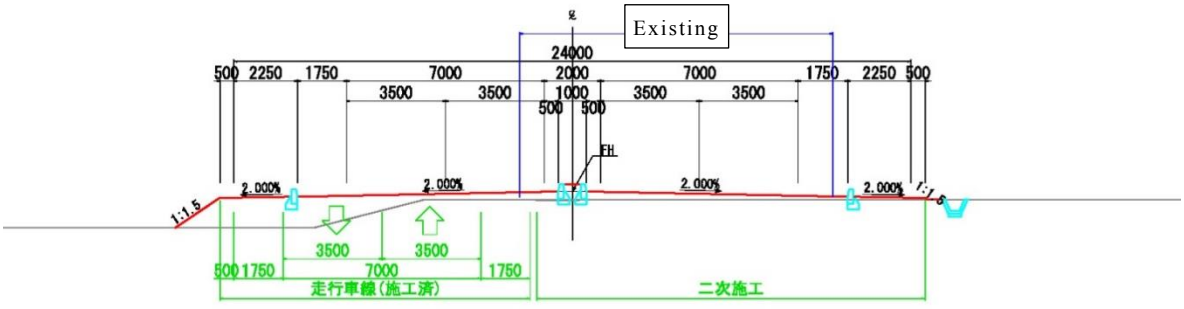


Figure 2.2-67 First Step Construction

2.2.5.3 Scope of Works

The responsibilities to be borne by Japan and the Republic of Tajikistan are summarized in Table 2.2-41.

Table 2.2-41 Responsibility of Each Government

Items	Contents/Requirements	Responsible Country		Remarks
		Japan	Tajikistan	
Land acquisition	Procurement before construction		○	
Electric power for traffic signal and street lighting	Power supply		○	
Procurement	Materials and equipment	○		Specific material will be procured from Japan.
	Customs clearance		○	
Land provision	Land Acquisition necessary for construction		○	Project Office, Accommodation Construction Yard
	Other than above	○		
Removal/Replacement of No.15 downstream bridge	Removal and Replacement		○	
Removal/Relocation of utilities	Relocation of Obstruction		○	Water pipe, electric cable, communication cable, sign board
Main Construction	Road, box culvert and traffic safety facility	○		

2.2.5.4 Consultant Supervision/Procurement

Basically, the Japanese Consultant will enter into an agreement with the Republic of Tajikistan to request their support for the bidding activities and the construction supervision.

(1) Detailed Design

The major works to be carried out by the detailed design consultant are as follows:

- Undertake consultations with concerned authorities of Tajikistan and carry out field surveys,
- Detailed design and drawings preparation
- Project cost estimate

The duration to carry out the detailed design work is about 6 months.

(2) Bidding Activities

The major tasks to be undertaken between the time of inviting contractors to bid and the time for signing of contract for construction includes:

- Preparation of bid documents (in parallel with the detailed design).
- Bid announcement
- Pre-qualification of bidders

- Bidding
- Evaluation of bid documents
- Preparation of Contract Agreement

The duration of the bid-related activities is about 3 months.

(3) Construction Supervision

The Consultant will supervise the Contractor's planning and implementation of the construction contract. The major tasks under this stage include:

- Verification/Approval of related surveys and quantities
- Review/Approval construction plans
- Quality Control
- Process Control
- Work Output Control
- Safety Management
- Turnover Inspection and Acceptance

The duration of construction supervision is approximately 22 months. The construction supervision team shall consists of 1-Resident/Chief Engineer (Japanese), 1-Site Inspectors (Local), 1-Clerk of Works (Local).and 1-Utility Personnel (Local).

A construction supervision engineer would be dispatched at the time of defect inspection. A safety control officer is necessary to supervise, talk and cooperate with a construction contractor's safety manager so that occurrence of an accident may be prevented.

2.2.5.5 Quality Control Plan

The tasks to be carried out for quality control during the construction period are as follows:

- Concrete Works
- Reinforcing Bars and Formworks
- Earthwork
- Pavement Works

Based on the above, the quality control of main items for concrete works is presented in Table 2.2-42 while the quality control of main items for pavement is presented in Table 2.2-43.

Table 2.2-42 Quality Control Plan of Concrete Works

Item	Test Items	Test Method	Test Frequency
Concrete	Cement Property/Physical Test	AASHTO M85	Once before trial mix and once every 500m^3 batch of concrete; or once during production of cement (Mill sheet)
Aggregate	Property/Physical Test	AASHTO M6	Once before trial mix and once every 500m^3 batch of concrete; and every change of source/quarry location (check supplier data)
	Property/Physical Test	AASHTO M80	Once before trial mix and once every 500m^3 batch of concrete; and every change of source/quarry location (check supplier data)
	Sieve Analysis	AASHTO T27	Once a month
	Alkali-silica Reactive Test (Mortar Bar Method)	ASTM C1260	Once before trial mix and every change of source/quarry location (check supplier data)
	Mineral Composition Test	ASTM C295	Once before trial mix and every change of source/quarry location (check supplier data)
Water	Water Quality Test	AASHTO T26	Once before trial mix and when necessary
Admixture	Quality Test	ASTM C494	Once before trial mix and when necessary (Mill Sheet)
Concrete	Slump Test	AASHTO T119	Once every 75m^3 or per batch
	Air Content Test	AASHTO T121	Once every 75m^3 or per batch
	Compressive Strength Test	AASHTO T22	6 Samples per batch or 6 samples for every 75m^3 of concrete (3 samples each for 7-day strength and 28-day strength)
	Temperature	ASTM C1064	Once every 75m^3 or per batch

Table 2.2-43 Quality Management Plan for Earthwork and Pavement Work

Item	Test Items	Test Method	Test Frequency
Embankment	Density Test (Compaction)	AASHTO T191	Every 500m^2
Base course	Material Test (Sieve Analysis)	AASHTO T27	Once before placing and once every 1,500m^3 or change in source/quarry location.
	Material Test (CBR Test)	AASHTO T193	Once before placing and once every 1,500m^3 or change in source/quarry location.
	Dry Density Test (Compaction)	AASHTO T180	Once before placing and twice every 1,500m^3 or change in source/quarry location.

Item	Test Items	Test Method	Test Frequency
	Field Density Test (Compaction)	AASHTO T191	Every 500m^2
Asphalt paving	Material Test (Sieve Analysis)	AASHTO M43,M80	Once before placing and once every 1,500m3 or change in source/quarry location.
	Material testing (density and percentage of absorption).	AASHTO T84	
	Density-in-situ examination.	AASHTO T209	Every 200m
Modified asphalt paving	Marshall stability test	ASTM D 1559-89	Design stage: Five samples every mix, three pieces = 15 times Trial mix stage:: Three samples every a mix, three pieces= 9 times Paving stage: Once before placing
	Dynamic Stability Test	Measurement of Plastic Deformation by Wheel Tracking Machine	At Trial Mix: Once per 1 mix At Construction: Once per paving asphalt of 1,000 ton
	Other tests	JIS	as may be necessary

2.2.5.6 Procurement Plan

(1) Procurement of Major Construction Materials

Procurement area of major construction materials are summarized into Table 2.2-44.

Table 2.2-44 Procurement Area of Major Construction Materials

Item		Procurement Area			Procurement Reason	Procurement Routes
Item Name	Item Name	Local	Japan	Third Country		
Materials for structures						
Reinforcing bars	D10～D32	○				Dushanbe
Cement	Portland	○				Dushanbe
Aggregate for concrete	0～30mm	○				Near construction site
Sub-basecourse	Graded grain crushed stone	○				Near construction site
Embankment		○				Near construction site
Bitumen		○				Dushanbe
Admixture for cement concrete		○				Dushanbe

Item		Procurement Area			Procurement Reason	Procurement Routes
Item Name	Item Name	Local	Japan	Third Country		
Admixture for modified asphalt concrete	Polymeric material Type-II		○		Difficult to procure locally	
Reflective road studs	Reflective panel equipped		○		Difficult to procure locally	
Temporary Materials						
Fuels, oils and lubricants		○				Near construction site
Timber formwork		○				Dushanbe
Temporary steel		○				Dushanbe
Support		○				Dushanbe
Steel formwork			○		For securing quality and work period reduction	
Soil bag			○			

1) Procurement of Ready-mixed Concrete and Aggregate

Ready-mixed Concrete for the box culverts and retaining wall shall be procured from the local concrete plants which are located in a distance of 5 km from construction site.

2) Procurement of Embankment Material

Embankment material shall be procured from the borrow pit which are located in a distance of 2 km from start point of the project site.

3) Procurement of Special Materials

Special materials which can not be procured in Tajikistan include reflective road studs, an admixture for modified asphalt concrete and soil bags. These materials shall be procured in Japan.

4) Others

a) Disposal Site

The Team specified the depression area at the left side of the road from KM 732+10 to KM 740+80 as the disposal site for this project (Figure 2.2-68).

b) Temporary Yard

The Team specified an area at the left side of the road from KM 737+20 to 742+10 as the temporary yard for this project (Figure 2.2-68).

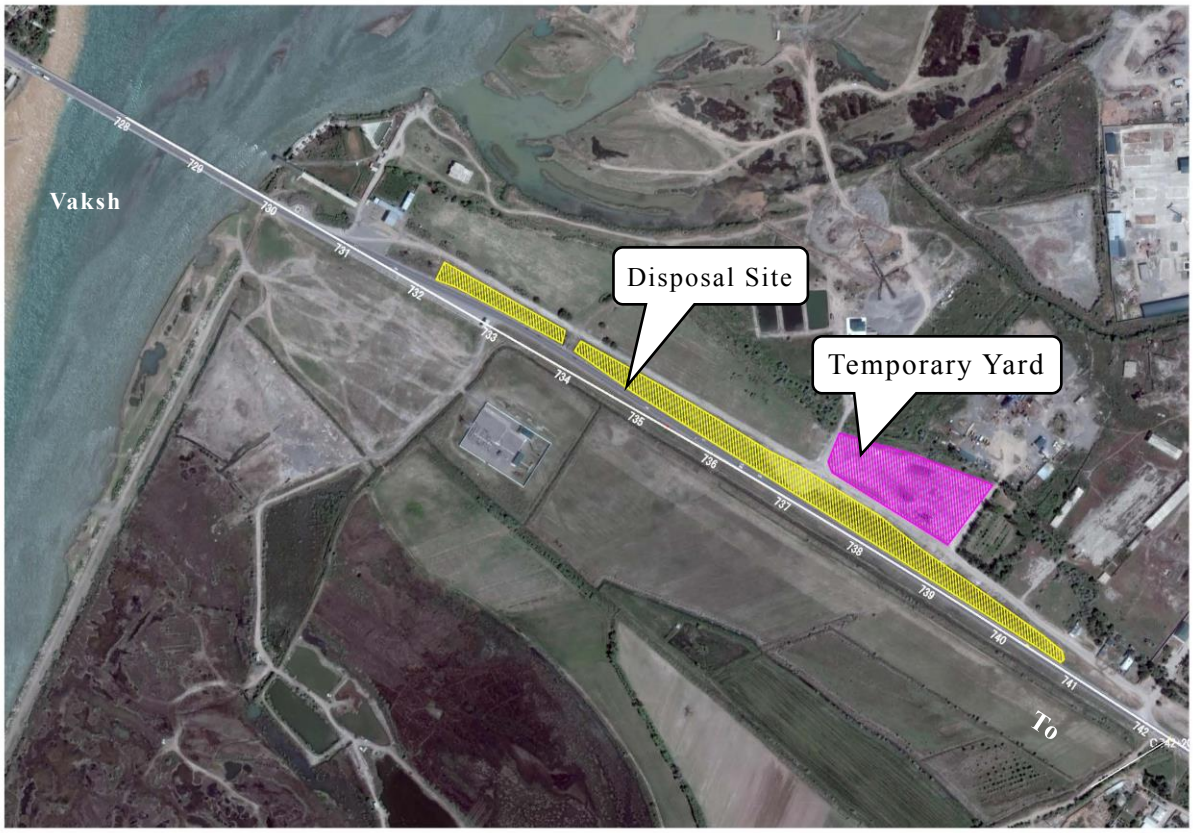


Figure 2.2-68 Location of Expected Disposal Site and Temporary Yard

(2) Procurement of Major Construction Equipment

Construction equipment to be procured is summarized in Table 2.2-45.

Table 2.2-45 Major Construction Equipment to be Procured

Item		Purchase/ Rent	Procurement Routes Rent/Buy			Procurement Reason	Procurement Routes
Name of Machine / Equipment	Description		Local	Japan	Third country		
Backhoe	0.28 m^3	Rent	○				Near construction site
Backhoe	0.45 m^3	Rent	○				Near construction site
Backhoe	0.8 m^3	Rent	○				Near construction site
Dump Track	10 t	Rent	○				Near construction site
Bulldozer	21 t	Rent	○				Near construction site
Tire Roller	8 to 20 t	Rent	○				Near construction site
Road Roller	10 to 12 t	Rent	○				Near construction site
Motor Grader	W=3.1 m	Rent	○				Near construction site
Wheel loader	2.5 m^3	Rent	○				Near construction site
Truck Crane	25 to 50 t	Rent	○				Near construction site
Truck Crane (rough terrain type)	25 to 50 t	Rent	○				Near construction site

Item		Purchase/ Rent	Procurement Routes Rent/Buy			Procurement Reason	Procurement Routes
Name of Machine / Equipment	Description		Local	Japan	Third country		
Crawler Crane	60 to 65 t	Rent	○				Near construction site
Heavy Weigh Breaker	1300 kg	Rent	○				Near construction site
Trailer	20 t	Rent	○				Near construction site
Vibration Roller	Drive type 3 ～4 t	Rent	○				Near construction site
Vibration Roller	Hand guide type	Rent	○				Near construction site
Concrete Pump Vehicle	90 to 110 m3/h	Rent	○				Near construction site
Water Truck	5.5 m3	Rent	○				Near construction site
Asphalt Finisher		Rent	○				Near construction site
Asphalt Plant	90 t/h	Rent		○		To secure quality	Japan
Facility for an admixture for modified asphalt concrete		Rent		○		Difficult to procure locally	Japan
Paved road surface cutter		Rent		○		Difficult to procure locally	Japan

2.2.5.7 Implementation Schedule

Figure 2.2-69 presents the implementation schedule of detail design and construction period.

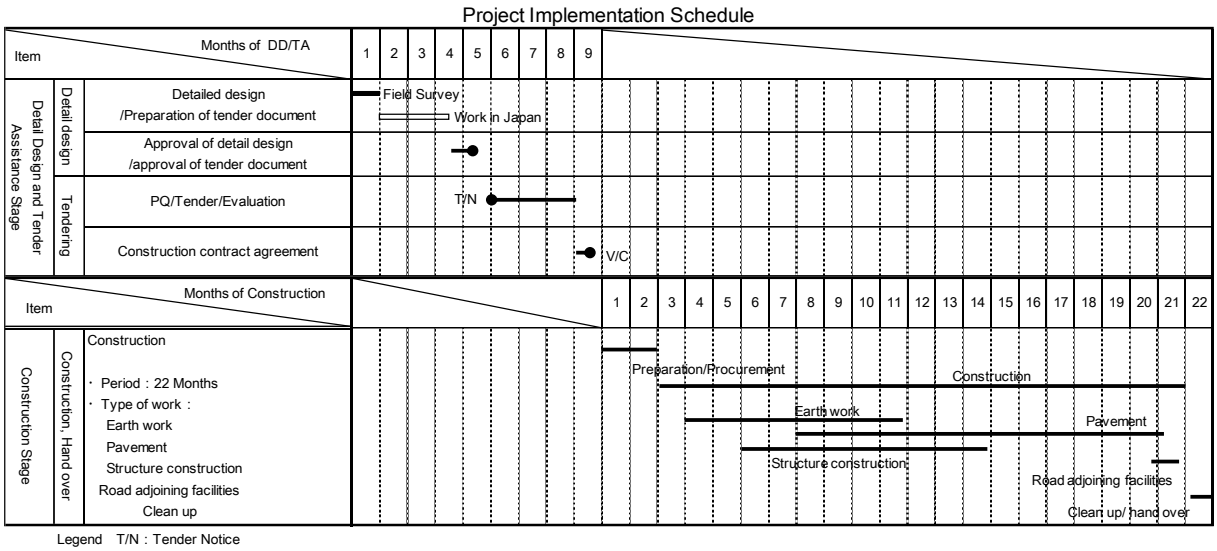
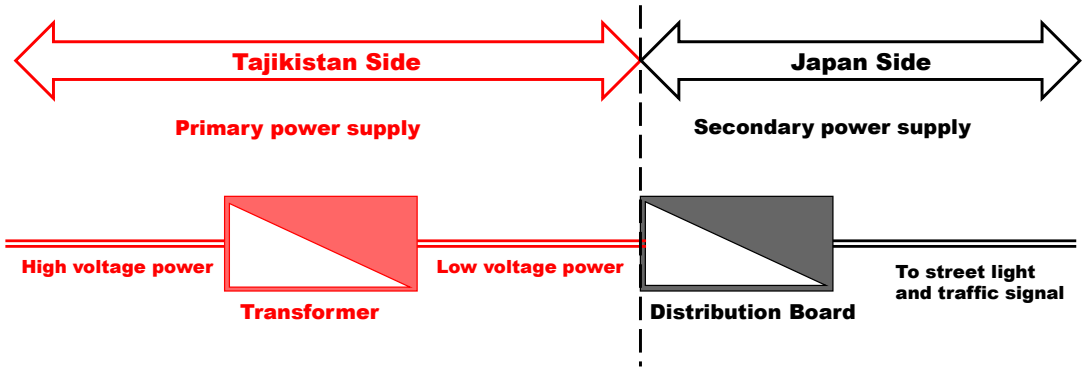


Figure 2.2-69 Implementation Schedule

2.3 Obligations of Recipient Country

The undertakings required from the GOT for the smooth execution of this project are as follows:

- To provide documents, data and information necessary for the execution of this project;
- To acquire land for construction yard;
- To secure land for construction yard, stock yard, disposal area for construction debris, site office yard, and detour routes;
- To secure borrow pits, spoil-banks, and industrial waste disposal areas;
- To obtain all necessary permits, to coordinate and share necessary information with concerned organizations regarding the method of road occupancy of the project road, procedure for allowing public vehicles, traffic restrictions, and day-time, night time works;
- To get the public informed and take necessary steps before hand regarding blockage of road for public vehicles during relocation of overhead facilities such as traffic signs;
- To coordinate with concerned organizations and agencies in charge of underground utilities pertaining to its protection, reinforcement/repair and to pre inform all road users and local inhabitants in case disruption of water and electricity are anticipated;
- To coordinate with concerned organizations and agencies in charge of street lights and electronic traffic signals regarding its protection and/or its relocation and to take necessary steps to inform road users beforehand in case disruption of electricity is anticipated;
- To obtain necessary permits that would allow the personnel engaged in the construction work such as the supervision engineer, construction workers etc. to access ROW;
- To obtain necessary permits that would allow the construction vehicles and equipment to enter and exit the ROW;
- To supply electricity power in accordance with the following demarcation agreed on T/N necessary for traffic signals and street lights;



- To enlarge the drainage capacity of pipe culvert which located at downstream of Bridge No.15 shown in Figure 2.2-49 within three years after completion of the Project.
- To bear the cost of bank charges such as the Advising Commission and Payment Commission to the Japanese bank where an account related to the project is opened.
- To bear all expenses required for 18 % of VAT (Value Added Tax)
- To assist in the process for exemption of materials imported for the construction work from taxation and Customs clearance in order to ensure smooth inland transportation;
- To assist in the process for exemption of Japanese nationals engaged in the construction work from Customs duties and other fiscal levies on products and services necessary for the execution of the project;
- To assist in the process for exemption of Japanese nationals from all legislation measures necessary for entering and staying in the Republic of Tajikistan;
- To ensure proper use and maintenance of the road after its construction, especially maintenance for surface treatment of median;
- To cooperate in solving potential troubles with the local people or any third party in connection with the execution of the project;
- To bear all expenses required for the execution of the project, other than those borne by the Grant-Aid of Japan.

2.4 Project Operation Plan

2.4.1 Operation and Maintenance Framework

2.4.1.1 Organizational Framework

International and national roads in Tajikistan are under the jurisdiction of MOT and they are maintained by SETMs (State Enterprises on Highway Maintenance) and SEHMs (State Enterprises for Transport Management). The Project Road will be maintained by Bokhtar SEHM under Bokhtar SETM.

The organization chart of MOT is indicated in Figure 2.4-1 and the organization chart of Bokhtar SETM is indicated in Figure 2.4-2.

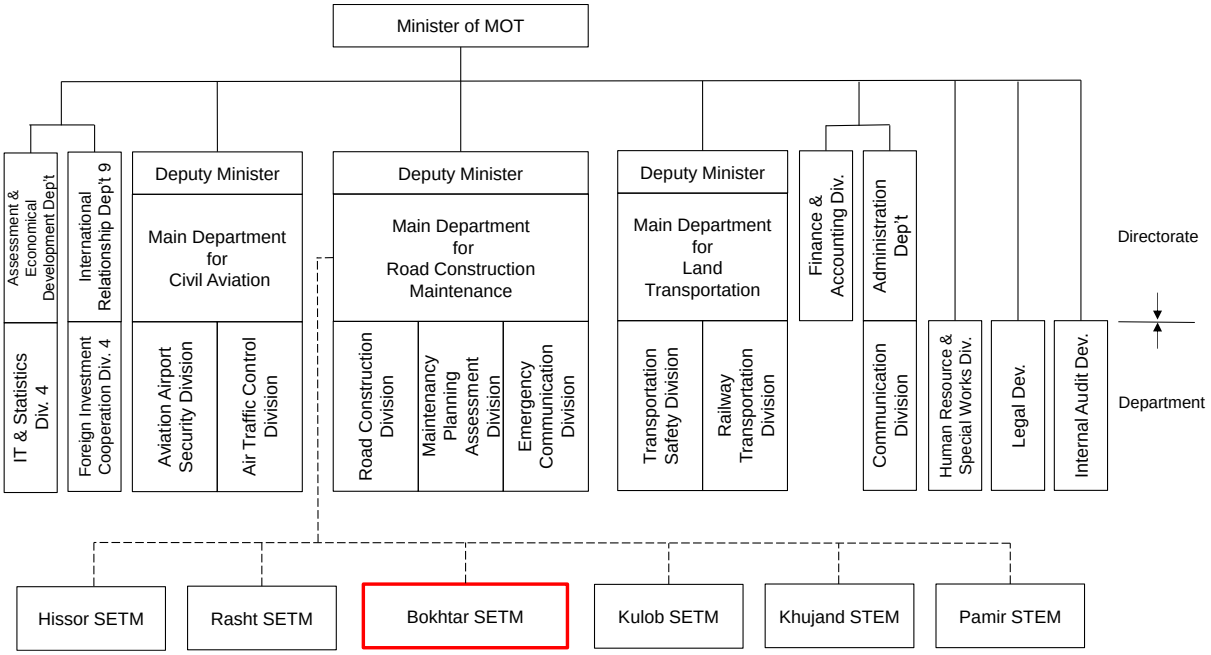


Figure 2.4-1 Organization Chart of MOT

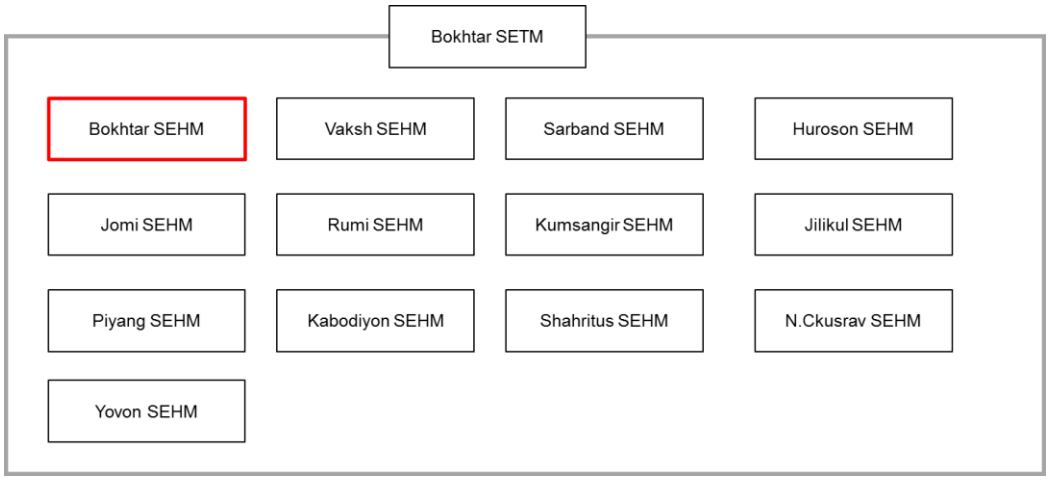


Figure 2.4-2 Organization Chart of Bokhtar SETM

2.4.1.2 Road Sector Personnel and Budget in MOT

The personnel list of MOT is indicated in Table 2.4-1. The yearly personnel number change for 6 SETMs is shown in Table 2.4-2. The personnel list of Bokhtar SEHM and the total personnel number of 13 other SEHMs are indicated in Table 2.4-3.

Table 2.4-1 Personnel List of MOT

Item		Sub Total	Total
Office Personnel			
	Management	4	77
	Department on Inland Transport	11	
	Department on Road Construction and Maintenance	16	
	Analysis and Economic Forecasting Department	12	
	International Relationship Department	10	
	Finance and Accounting Department	7	
	Administration Department	8	
	Human Resources and Special Works Division	4	
	Legal Sector	2	
	Internal Audit Sector	3	
Operational Personnel			
	Operational Personnel	24	24
Total			114

Table 2.4-2 Yearly Personnel Number Change of 6 SETMs

SETM	Year				
	2013	2014	2015	2016	2017
Gissar	364	365	365	373	373
Kulyab	489	483	483	475	486
GBAO	579	573	579	579	590
Rasht	242	240	241	241	241
Bokhtar	534	521	522	522	525
Sughd region	707	701	701	701	701
Total:	**2,915**	**2,883**	**2,891**	**2,891**	**2,916**

Table 2.4-3 Personnel List of Bokhtar SEHM and 13 Other SEHMs

No	Name of SETM	Personnel No.
	Bokhtar (Kurgan-Tyube) SETM	24
	13 SEHM Total	501
Total		525
No	Name of SEHM	Amount
1	Kushoniyon (Bokhtar)SEHM	35
2	Vakhsh SEHM	37
3	Levakand (Sarband)SEHM	34
4	Abdurahmoni Jomi SEHM	35
5	Jaloliddini Balkhi SEHM	33

6	Dusti(Jillikul)SEHM	52
7	Jaihun (Qumsangir)SEHM	39
8	Pyandzh SEHM	38
9	Yovon SEHM	45
10	Shahrituz SEHM	42
11	Qubodiyon SEHM	34
12	N.Khusrav SEHM	32
13	Khuroson SEHM	45
Total		501

The Project Road lies within the jurisdiction of Bokhtar SETM and road maintenance upon commissioning is planned to be conducted by Bokhtar SEHM. The budgetary allocation to 6 SETMs for the past 5 years is indicated in Table 2.4-4. The detailed yearly budgetary allocation change for Bokhtar SETM for the past 8 years is shown in Table 2.4-5.

The budget to each SETM for the past 5 years does not indicate any drastic increase nor decrease, but more or less fixed. Bokhtar SETM is provided with 8.64 million Somonis (equivalent to JPY 100,000,000) and 17% of the budget allocated to 6 SETMs. Out of such, road maintenance receives 32% of the budget to maintain 2,740.3 km of road under its jurisdiction. This indicates that for 1km of road maintenance, only 3,150 Somonis is allocated and the SETM faces a chronic budget shortage. As such, efficient and effective action is required for road maintenance services.

Table 2.4-4 Budgetary Allocation to 6 SETMs (Past 5 Years)

(Unit: Million Somonis)

SETM	2014	2015	2016	2017	2018	Allocation % to Each SETM (2018 Based)
Gissar	5.993	6.306	7.851	7.150	7.176	14.30%
Bokhtar	7.909	8.298	8.888	8.643	8.643	17.20%
GBAO	10.075	10.544	11.312	10.976	11.015	21.90%
Rasht	7.324	7.683	8.075	8.281	8.371	16.60%
Kulyab	9.378	9.813	10.521	10.768	10.694	21.20%
Sughd region	4.720	4.396	4.484	4.423	4.434	8.80%
Total	45.401	47.041	51.132	50.243	50.334	100%

Table 2.4-5 Yearly Budgetary Allocation Change for Bokhtar SETM (Past 7 years)

(Unit: Thousand Somonis)

Year	Road Maintenance	Rehabilitation	Contingency	Salary	Total
2011	2,107.80	223.50	389.50	2,126.40	4,847.20
2012	2,762.20	229.40	473.30	2,538.90	6,003.80
2013	2,778.00	220.00	498.40	3,412.00	6,908.40
2014	2,781.00	580.00	537.30	4,010.00	7,908.30
2015	3,116.20	580.00	592.40	4,010.00	8,298.60
2016	3,123.10	630.00	592.40	4,542.40	8,887.90
2017	2,749.21	562.59	562.44	4,768.89	8,643.13

2.4.2 Contents of Operation and Maintenance

Road maintenance services conducted by each SEHM are as shown below. Almost all of such services are conducted directly by each SEHM.

- Pavement repair
- Repair of ancillary structures
- Cleaning of carriageway and gutters/ditches
- Vegetation
- Traffic signals and lighting
- Bridge maintenance

2.4.3 Points to Consider in Road Operation and Maintenance

In order to generate and sustain the project impact, it is necessary to maintain the road and ancillary structures satisfactorily so that to enable smooth traffic as well as maintaining road durability. As the Project Road is not only being used by vehicles, but together by pedestrians and community people, additional measures to maintain facilities on traffic signals/control and road safety are of vital importance. These points are indicated below;

- Conduct road patrol and inspections to be in constant touch of road conditions.
- Cleaning of road and ancillary structures, especially drainage facilities and nearby.
- Constant inspection, cleaning and repair of facilities on traffic signals/control and road safety.
- Obtain necessary budget on road maintenance.

Satisfactory operation and maintenance would be possible by observing the above points.

2.5 Project Cost Estimate

2.5.1 Initial Cost Estimation

(1) Japan's Contribution

The cost borne by the Japanese's Grant Aid is not shown in this report due to the confidentiality.

(2) Tajikistan's Contribution

The approximate amount estimated for contribution from Tajikistan is shown in Table 2.5-1.

Table 2.5-1 Approximate Cost Estimation of Tajikistan Contribution

Item	Amount (US$)
1) Bank Charges	67,000
2) Temporary Yard (Rental etc.)	43,800
3) Relocations of underground utilities	160,000
4) Removal of overhead obstacles (electric poles, bill boards, etc.)	161,000
5) Removal of public facilities	42,000
6) Expense/compensation for removal of buildings	191,000
7) Land acquisition, compensation	139,000
8) Expense for registration	8,000
9) Expense for primary power supply (street lights)	40,000
10) Expense for replacement of pipe downstream Br. No. 15	460,000
11) Annual Maintenance Cost for Road	5,000
Total	1,316,800

(3) Cost Estimation Condition

① Cost Estimation Date : June 2018

② Foreign Exchange Rate : US$1.00=108.75JPY

③ Construction Period : Schedule of construction supervision is shown in the implementation schedule

④ Others : The project is carried out based on the Japanese Government's Grant Aid Scheme.

2.5.2 Operation and Maintenance Cost

MOT is responsible for securing the budget for operation and maintenance cost. The table indicating various maintenance items and applicable costs are indicated Table 2.5-2.

Essential expenses are fuel costs for vehicles and machineries required for maintenance as the SEHM carries out operation and maintenance directly. Bitumen will be provided by MOT and aggregates are provided by the plant in charge of asphaltic plant.

The Project introduces L-type gutters and box culverts for ease of maintenance and modified asphalt concrete for more durability purpose. It is therefore expected that there would only be minimal operation and maintenance costs at the early commissioning stage.

Table 2.5-2 Maintenance Cost

Maintenance Items	Action	Frequency	Equipment Materials	Amount (TJS)
Routine Maintenance	Patrol, cleaning and removal of debris	Daily	Blooms and pickup truck	2,000TJS (Per Year)
Regular Inspection	Regular inspection on road conditions, damage and deformation	Once/month	Shovels/hammer/sickle/barriers/pickup truck	2,000TJS (Per Year)
	Inspection on cracks on structures	Once/year		2,000TJS (Per Year)
	Inspection on road lighting	Once/month	Pickup truck	2,000TJS (Per Year)
Repair	Repair on shoulders and embankment	Twice/year	Plate compactor/basecourse material/asphaltic concrete/ordinary portland cement/flat bodied truck	2,000TJS (Per Year)
	Repair on pavement	Once/year		20,000TJS (Per Year)
	Repair on concrete structures	Once/year	Ordinary portland cement/flat bodied truck	10,000TJS (Per Year)
	Replacement of lights	Once/year	Lamps	5,000TJS (Per Year)
Total				**45,000TJS** (551,000JPY)

1.0TJS=12.247JPY

CHAPTER 3 Project Evaluation

3.1 Preconditions

The Project preconditions related to the required undertaking from the Republic of Tajikistan are as follows:

- Banking Arrangement (B/A) with a Bank in Japan shall be concluded within one (1) month after the signing date of Grant Agreement (G/A).
- The payments will be made when payment requests are presented by the Bank under an Authorization to Pay (A/P). This A/P shall be issued to the Bank that concluded B/A within one (1) month after Consulting Service Agreement is made.
- Before the date of formal invitation to Pre-Qualification, such public utilities, like power poles, electric lines/cables, and communication network lines/pipes as will interrupt the Project works shall be all relocated to the locations where no hindrance and inconvenience shall occur.
- It is essential that land, stock yard, borrow pits, spoiled-banks and industrial waste disposal for Project construction shall be acquired prior to public announcement of Pre-Qualification and no pending issues in relation to this shall be left behind.
- Prior to commencement of the works, adequate and proper compensations and resettlement in accordance with ARAP shall be undertaken for the sake of the PAPs.
- Any necessary actions for tax exemption shall be taken keeping to the regulations of E/N and G/A.
- Quick and smooth customs declaration and import tax formalities shall be totally finished when the imported materials or goods arrive from Japan and any other third countries.
- Agreement on the project implementation with the related organizations (Bokhtar City, traffic police and Construction and Architecture Agency under the Government of Tajikistan) shall be made before commencement of construction work.
- Necessary permits for taking borrow pits and cutting trees which disturb the facilities shall be obtained before commencement of construction work.
- Throughout all the construction period, quarterly monitoring Report shall be prepared for submittal to JICA. This Report shall describe monitoring data about such potential natural environmental items as air quality, water pollution, etc. which is more likely to give impacts on the works during construction phase and even after it is completed.
- During construction period, eminent assistance shall be given to traffic handling and management plus safety control management.
- The power pipes/lines and water supply pipes/lines necessary for the construction work at site shall be routed and installed.
- As a means of dispute resolution while the works proceed, discussion and assistance in good

earnest shall be made to reach agreement on disputes with people in the vicinity or any other third party around.

3.2 Necessary Inputs by Recipient Country

After the Project completion, bridges and roads maintenance is necessary not only to provide smooth flow of traffic but also to prolong the life of the structures and the roads. Maintenance work includes daily or routine maintenance, removal of obstacles, cleaning, etc. Periodic inspection shall be carried out and if damage is observed to structures and pavements essential repairs will be undertaken appropriately. Therefore, it is an important assumption that MOT secures an annual maintenance budget (approximately 5,000 US Dollar) to maintain and repair the facilities. As noted in the earlier sections, the allocation of operation and maintenance budget in Tajikistan is considered possible.

3.3 Important Assumptions

The important assumptions of the Project outcome are as described below:

- Maintenance of not only drainage facilities but also pavement and ancillaries shall be properly and periodically made.
- Activity on Traffic safety education to the road users particularly for neighborhood resident along the project road shall be carried out by MOT in cooperation with traffic police. Specially, regulated speed shall be facilitated.

3.4 Project Evaluation

3.4.1 Relevance

- An approximate 340,000 residents of the project area are direct beneficiaries of the Project. On the other hand, an approximate 2.7 million people is assumed users of project road.
- This Project will contribute to easing traffic congestion and smoothing transportation of people and freight as well. It is highly expected that this will eventually lead to a comprehensive transportation network development for logistics throughout the nation.
- This Project will be immediately and strongly needed to secure stability of people's lives, development of their daily lives, and securing BHN (Basic Human Needs).
- Excessively advanced technique is not necessary for this Project. Tajikistan side can manage to run, operate and maintain the improved road, related structures, and facilities by using own fund, own local manpower and locally available technical skills.
- This project will be equally consistent with the policy and target described in the NDS (National Development Strategy to 2030). This Project can help in achieving enhancement of AH network improvement.
- There is little negative impact upon environmental and social condition.

- Performing the Project will justify the incentive as well as necessity to utilize Japanese most advanced and cutting-edge construction technology, such as time control, safety control, and quality control. Through the Japan's Grant Aid Scheme, the Project will be conducted adequately without any serious issues.

3.4.2 Effectiveness

(1) Quantitative Effect

The expected quantitative effect to be produced through performing the works of target Project for economic cooperation is shown in the following Table 1.3-1. The values of base year (2018) before conducting the Project and target year (2024) in three (3) years over completion of the Project are respectively set up.

Table 3.4-1 Quantitative Effects

Index	Current Value (as of 2018)	Design Value (as of 2024)
Traffic Volume	15,560 vehicle/day	21,100 vehicle/day
Volume of Passengers	69,966 person /day	84,700 person /day
Volume of Cargo	7,503 ton / day	9,700 ton / day
Travelling Time* *Dushanbe – Bokhtar Road starting from the beginning of improved section to the end point of the project, including ADB section	102.2 minute	84 minute

(2) Qualitative Effect

The prospective effects are;

(1) To promote logistics efficiency and improve punctuality between Dushanbe and Afghanistan
(2) To contribute vitalization of economic activity by reducing transporting cost
(3) To secure traffic safety for pedestrian due to installation of sidewalk
(4) To improve traffic safety in driving during night time