ECONOMIC AND FINANCIAL ANALYSIS

A. Project Description

1. The proposed project will finance the construction of a 151-kilometer section of road in northwestern Afghanistan from Qaisar to Dari Bum. The road is the last missing link of the national Ring Road and a top priority in the country's Transport Sector Master Plan.[1] The project road is also part of Central Asia Regional Economic Cooperation Program (CAREC) Corridor 6, linking the Middle East and South Asia with Europe. The physical condition of the project road is poor. The asphalt concrete pavement has failed over most of its length so that the surface roughness is estimated to be in the range of 10 to 16 as per the international roughness index (IRI).[2] The proposed project will also contain a community development component, which will build basic infrastructure such as rural access roads, culverts, mosques, or small-scale irrigation schemes to support local communities within the project road area and increase their engagement in the project. Two capacity-building components, one on mainstreaming climate change and disaster risk in the transport sector and the second on strengthening project management in the Ministry of Public Works (MPW), are included in the scope of the project and constitute two distinct outputs.

2. Under the without-project scenario, a status quo in terms of the maintenance regime is assumed, resulting in the road surface remaining poor. An IRI of 16 is consistent with the current condition of the road and is expected to remain at that level under the without-project scenario.

3. The with-project scenario assumes a better road quality and a more systematic and rational maintenance regime. Periodic maintenance interventions are scheduled at intervals of 6 years. Each intervention reduces the IRI to its original level.

B. Demand Analysis

4. Traffic counts were carried out on 2 days in 2017 to ascertain the level of usage of the project road. The counts resulted in annual average daily traffic (AADT) of 3,255 vehicles. Table 1 shows the current traffic volumes, its composition, and the traffic forecast based on an annual growth rate of 5% as per the long-term gross domestic product projections for Afghanistan. The AADT numbers include estimates for generated traffic accounting for about 30% of AADT.[3]

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[1] ADB. 2017. *Islamic Republic of Afghanistan: Transport Sector Master Plan Update*. Manila.

[2] The international roughness index (IRI) measures pavement performance and riding quality. The index is used to define a characteristic of the longitudinal profile of a traveled wheel track and constitutes a standardized roughness measurement. The measurement units are meters per kilometer (m/km) or millimeters per meter (mm/m). The IRI is based on the ratio of a standard vehicle's accumulated suspension motion caused by roughness (in mm, cm, or inches) divided by the distance traveled by the vehicle during the measurement (m, km). The IRI scale is open-ended.

[3] ADB. 2016. *Asian Development Outlook 2016*. Manila.

Table 1: Forecast Annual Average Daily Traffic on the Project Roads (2017–2026)

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Cars and pickups	875	919	965	1,013	1,064	1,117	1,173	1,231	1,293	1,357
Buses	295	310	325	341	359	377	395	415	436	458
Light Trucks	155	163	171	179	188	198	208	218	229	240
Medium Trucks	200	210	221	232	243	255	268	281	295	310
Heavy Trucks	10	11	11	12	12	13	13	14	15	16
Tractors	20	21	22	23	24	26	27	28	30	31
Motorcycles	1,700	1,785	1,874	1,968	2,066	2,170	2,278	2,392	2,512	2,637
Total	**3,255**	**3,418**	**3,589**	**3,768**	**3,956**	**4,154**	**4,362**	**4,580**	**4,809**	**5,050**

Source: Ministry of Public Works, Afghanistan.

C. Methodology

5. A cost–benefit analysis was conducted in accordance with the Asian Development Bank (ADB) Guidelines for the Economic Analysis of Projects by comparing the with-project and without-project scenarios.[4] The scope of the economic analysis did not include the capacity development components as explained in para. 1—the costs associated with these components are less than 5% of total project costs. The analysis was conducted using the world price numeraire, and with all costs and benefits expressed in US dollars ($) at 2017 constant prices. Inputs and outputs of the project were broken down into their traded and non-traded components. The standard conversion factor (SCF) of 0.9 was applied to the non-traded components, as is usual for projects in Afghanistan.[5]

6. The approach to estimating the economic feasibility of the proposed project follows the analytical framework of the Highway Development and Management (HDM) Model, which is based on the concept of pavement life-cycle analysis.[6] The key assumption is that road pavements deteriorate as a result of several factors, including traffic loading, climatic conditions, and maintenance regimes. Impacts of the road condition and design standards on road users are measured to predict economic resource consumption reflected in economic costs. These road user costs comprise vehicle operating costs (VOCs) such as fuel, tires, oil, spare parts consumption, depreciation, and capacity utilization; as well as costs of travel time for both passengers and freight.

D. Costs

7. The total financial cost of the project is estimated at $334.0 million. The financial cost includes an implicit tax component of 6.5%, which was deducted from the financial cost. Price contingencies also were deducted from the analysis. These adjustments resulted in an amount of $292.9 million.

[4] ADB. 2017. *Guidelines for the Economic Analysis of Projects*. Manila.

[5] This figure was used for the Energy Supply Improvement Investment Program approved in 2015. https://www.adb.org/sites/default/files/linked-documents/47282-001-efa.pdf

[6] World Road Association–PIARC. 2002. *HDM-4 Version 2*. Paris.

Table 2: Financial Project Cost
($ million)

Civil works	262.0
Equipment	2.0
Consulting services	30.0
Support to PMO	6.0
Land acquisition and resettlement	4.0
Physical contingencies	23.0
Price contingencies	7.0
Total	334.0

PMO = program management office.
Source: Project administration manual, Asian Development Bank.

8. The reduced financial cost of $297.2 was further adjusted to reflect the economic cost. As the analysis was done using the world price numeraire, internationally traded goods were expressed at border prices, whereas non-traded goods were multiplied by the SCF. For unskilled labor, a shadow wage rate factor of 0.8 was assumed, and applied together with the SCF. Because data is lacking, the economic price of land was difficult to ascertain. For conservativeness, the financial price was used, and the SCF was applied. Table 3 shows the results of the conversion as applied to the project's financial cost.

Table 3: Conversion of Financial Cost into Economic Cost
($ million, 2017 prices)

Cost Category	Subcategory	Financial cost items	Net of tax	Conversion factors	Economic cost
LA&R	Non-traded	4.0	3.7	0.9	3.4
Civil works	Traded material and equipment	150.0	140.3	1.0	140.3
	Non-traded material and equipment	45.0	42.1	0.9	37.9
	Surplus labor (non-traded)[a]	26.0	24.3	0.7	17.5
	Non-surplus labor (traded)	26.0	24.3	1.0	24.3
	Transport (non-traded)	15.0	14.0	0.9	12.6
Equipment	Traded	2.0	1.9	1.0	1.9
	Non-traded	0.0	0.0	0.9	0.0
Consulting services	Traded	30.0	28.1	1.0	28.1
Support to PMO	Traded	6.0	5.6	1.0	5.6
Price contingency	Traded	6.5	6.1	0.0	0.0
	Non-traded	0.0	0.0	0.0	0.0
Physical contingency	Traded	17.5	16.4	1.0	16.4
	Non-traded	6.0	5.6	0.9	5.0
Total cost		334.0	312.3		292.9

LA&R = land acquisition and resettlement, PMO = Program Management Office.
[a] A shadow wage rate factor of 0.8 and the standard conversion factor of 0.9 were applied.
Source: Asian Development Bank estimates.

E. Benefits

9. The quantified benefits are VOC savings and time cost savings for normal and generated traffic. Generated traffic accounts for around 30% of the annual average daily traffic. The benefits of generated traffic were derived based on the “rule of a half”, resulting in 14.5% of the benefits accruing to such traffic. The quantities of resources consumed and vehicle speeds were calculated first and then multiplied by unit costs of the resources to obtain total operating costs and travel time costs. The resources consumed and the vehicle operating conditions are a function of traffic volumes and the composition of traffic by vehicle types, pavement type, and geometric characteristics of the road as well as the roughness of the road surface. Benefits were broken down into traded and non-traded components. The non-traded benefits were converted by applying the SCF.

10. **Vehicle operating cost savings**. The maintenance intervention under the project lead to a reduction in VOC for the users of the improved road. The resulting VOC savings are the most substantial and direct benefit category. The resources consumed are reflected in the key VOC items—fuel, tires, maintenance parts, maintenance labor, lubricants, crew, depreciation, interest, overheads, passenger time, and capital tied up by freight in transit. The VOC unit rates were derived from the VOC module of the HDM-4 model.

11. **Travel time savings**. Improved road conditions will result in time savings, which were computed with respect to passengers and freight. All passengers were assumed to accrue a monetary benefit from the saving in travel time. The travel time on the project section under the present condition is about 5 hours. Under the with-project scenario, this time can be reduced to about 3 hours, generating time savings of 2 hours per passenger or freight trip.

12. Calculating the cost per passenger-hour requires quantifying the value of time in monetary terms. Toward this end, assumptions were made regarding the composition of time in terms of remunerative working and non-working time. The value of working time is directly related to the hourly wage rate net of taxes. No distinction was made between passengers traveling for a productive purpose and passengers traveling for leisure. Given the country’s situation, the occurrence of leisure travel would be negligible. The value of working time for car passengers and drivers is estimated at $1.0 per hour, which is the estimated weighted average wage for workers employed in and around the towns of origin and destinations.

13. As to freight, savings occur in the form of interest savings thanks to a shorter time that capital is tied up in vehicles and freight during transit. The prices involved in vehicle time savings are international prices free of taxes and duties as provided by the HDM-4 model. The freight on the road is dominated by general freight carried and agricultural produce. It is estimated that the weighted average of the freight mix is $450 per ton carried. The interest rate applied is 8%, which has been the average cost of capital in real terms over the past 5 years.

14. **Community development**. The community development components will benefit an estimated 27,000 persons in 60 communities. Given the average size of families (six people), about 4,500 heads of families may benefit from remunerative employment. The quantification of associated economic benefits was not attempted because of methodological challenges.

F. Results of the Analysis

15. The economic analysis was carried out by comparing costs and benefits with and without the project. The economic life of the road asset was estimated at 20 years, considering the scheduled periodic maintenance interventions. The computed economic internal rate of return (EIRR) of 12.4% exceeds ADB's benchmark rate of 9%. Details of the cost and benefit streams are in Appendix 1.

16. Sensitivity analysis is carried out to assess the impact of variations of the different parameters on the project outcome. Switching values—showing the change in a parameter required for the project decision to shift from acceptance to rejection—were also computed for key parameters. The important variables that are to be considered in this regard are (i) cost of the proposed investment; (ii) traffic volumes, both baseline flows and forecast future flows; and (iv) a combination of the two variables. The results indicate that the examined changes will not endanger the economic viability of the project, with the EIRR remaining well above the benchmark of 9%. The switching value indicates that it would require a 29.5% increase in project cost to reduce the EIRR to the benchmark level of 9%. A reduction in traffic by 24.3% has the same impact (Table 4).

Table 4: Sensitivity Analysis

	Scenario	**EIRR** (%)	**Switching Value**
A	Normal case	12.4	
B	Increase in capital cost by 10%	11.1	29.5%
C	Decrease in traffic by 10%	11.0	(24.3%)
D	Combined impact of (B) and (C)	9.8	

( ) = negative, EIRR = economic internal rate of return.

G. Financial Sustainability Analysis

17. Government funding for maintenance is considered a major risk in Afghanistan. Given the country's narrow economic base and competing claims on scarce budget resources, Afghanistan will in the foreseeable future have to rely on donor contributions to finance road maintenance. The government needs about $250 million annually to maintain its roads, while the revenue collected through road user charges totaled $69.5 million in 2015. This amount would be adequate to cover annual routine maintenance for the entire network under the purview of the MPW. However, in the same fiscal year, the Ministry of Finance allocated only about $21 million to MPW. In general, revenues from road users—rather than being earmarked for road financing—are part of the general budget.

18. Table 5 shows the development and composition of road expenditures for the period 2010–2014. The government has used its own resources to finance routine maintenance, while the development budget is financed by donors. During the 5-year period shown in Table 6, the government has on average spent around $23 million per year for routine (preventive) maintenance.[7] This accounts for only 5% of the total resources allocated to roads. Moreover, with

[7] Routine maintenance is an annual activity and is to keep roads in serviceable condition or prevent them from falling into disrepair prematurely. Typically, routine maintenance includes pothole repairs, edge patching, crack sealing and filling, shoulder repairs, and drainage cleaning.

$822 per km, the amount was grossly inadequate.[8] Supported by donors, the government has initiated steps for the introduction of a rational and systematic operation and maintenance regime that would create and maintain transport infrastructure in a cost-effective manner. To this end, an asset management system is being developed and a review of road user charges and their allocation is underway.

Table 5: Development of Maintenance Expenditures and Total Road Investments

		2010	2011	2012	2013	2014	Annual Average
	Government's own resources ($ m)						
	Routine maintenance	14.1	20.8	13.9	26.9	17.5	18.7
	Salang Tunnel O&M	4.3	5.2	2.1	5.4	3.5	4.1
A	Subtotal ($ m)	18.5	26.0	16.0	32.3	21.1	22.8
	Donor financing ($m)						
B	Reconstruction and rehabilitation	909.0	381.0	416.0	325.0	634.0	533.0
A+B	Total expenditure ($m)	927.5	407.0	432.0	357.3	655.1	555.8
A/(A+B)	Share of O&M in total expenditure	2.0%	6.4%	3.7%	9.0%	3.2%	4.9%

m = million, O&M = operation and maintenance.
Source: Ministry of Public Works 2015.

[8] International benchmarks for routine maintenance are in the range between $1,500 per km and $3,000 per km depending on the road surface, terrain, and topography. For Afghanistan, an adequate allocation should be closer to $3,000.

Table 6: Results of Economic Evaluation
($ million, 2017 prices)

	Costs			Benefits to Normal Traffic		Benefits to Generated Traffic		
Year	Capital Costs	Incremental Recurrent Cost	Total Cost	VOC Savings	Time Savings	VOC Savings	Time Savings	Net Benefits
2017	2.9	0.0	2.9	0.0	0.0	0.0	0.0	-2.9
2018	43.9	0.0	43.9	0.0	0.0	0.0	0.0	-43.9
2019	102.5	0.0	102.5	0.0	0.0	0.0	0.0	-102.5
2020	128.8	-0.6	128.2	16.5	6.0	2.8	1.0	-101.9
2021	14.6	-0.7	13.9	17.9	6.4	3.0	1.1	14.5
2022	0.0	-0.7	-0.7	19.2	6.8	3.3	1.2	31.2
2023	0.0	-0.8	-0.8	19.9	7.2	3.4	1.2	32.5
2024	0.0	-0.9	-0.9	20.7	7.5	3.5	1.3	33.8
2025	0.0	-1.0	-1.0	21.4	7.8	3.6	1.3	35.1
2026	0.0	-1.1	-1.1	22.1	8.1	3.7	1.4	36.4
2027	7.4	-1.2	6.2	22.7	8.4	3.8	1.4	30.1
2028	0.0	-1.3	-1.3	25.7	9.2	4.4	1.6	42.1
2029	0.0	-1.4	-1.4	26.8	9.5	4.5	1.6	43.9
2030	0.0	-1.5	-1.5	27.8	9.9	4.7	1.7	45.6
2031	0.0	-1.7	-1.7	28.6	10.4	4.9	1.8	47.4
2032	0.0	-1.8	-1.8	29.6	10.8	5.0	1.8	49.0
2033	7.4	-2.0	5.4	30.4	11.2	5.2	1.9	43.3
2034	0.0	-2.1	-2.1	34.5	12.2	5.9	2.1	56.8
2035	0.0	-2.3	-2.3	35.8	12.8	6.1	2.2	59.1
2036	0.0	-2.5	-2.5	37.2	13.4	6.3	2.3	61.7
2037	0.0	-2.7	-2.7	38.4	13.9	6.5	2.4	63.9
2038	0.0	-2.9	-2.9	39.7	14.5	6.7	2.5	66.2
2039	7.4	-3.2	4.2	40.8	15.0	6.9	2.5	61.1
2040	-14.2	-3.4	-17.6	46.3	16.4	7.8	2.8	90.9

EIRR = 12.4%
NPV = $68.10

EIRR = economic internal rate of return, NPV = net present value, VOC = vehicle operating cost.
Source: Outputs of HDM-4 Analysis.