ECONOMIC AND FINANCIAL ANALYSIS

A. General

1. According to International Monetary Fund (IMF) statistics, the Kyrgyz Republic's economy grew by an average of 2.65% per year during 2014–2015, despite multiple challenges. Political events, economic crises, and technical issues affecting gold production have periodically undermined growth. The IMF estimated that the country's gross domestic product (GDP) will grow 3.2% in 2016 and 4.0% in 2017. In line with this overall economic growth, car ownership has increased rapidly in the last decade; the overall number of registered vehicles (mostly secondhand) has more than tripled. Table 1 shows vehicle registrations in 2015.

Table 1: Registered Vehicles in the Kyrgyz Republic in 2015

Year	Motorcycles	Cars	Buses	Trucks	Trailers	Special Vehicles	Total
2015	6,528	809,260	42,439	121,675	25,548	9,902	1,015,352

Source: The Kyrgyz Republic's vehicle registration center.

2. Road transport plays a dominant role in the Kyrgyz Republic's transport system, accounting for about 95% of cargo and 96% of passenger traffic in 2015. The total length of the road network is about 35,000 kilometers (km), of which 18,585 km are public roads maintained by the Ministry of Transport and Roads (MOTR), while the remainder are maintained by cities, villages, and agricultural, industrial, and other entities. Public roads are classified as (i) international (4,100 km, including 2,242 km of international transport corridors), (ii) national (5,335 km), and local (9,149 km). There are 7,580 km of paved public roads, including 10 km of cement concrete, 5,698 km of asphalt concrete, and 1,871 km of black gravel pavements. The rest of the roads are paved with gravel (9,388 km) and earth (1,617 km).

3. International transport corridors provide the Kyrgyz Republic with access to regional markets for goods and services, and play an important role in linking the main domestic economic centers. International transport corridors carry 75% of road traffic in the country. From a regional perspective, Central Asia Regional Economic Cooperation Corridors 1 and 3 form a large "X", with the Kyrgyz Republic located at the center. Corridor 1 connects the Kyrgyz Republic to destinations in Eastern Russia and Europe to the northeast, and the People's Republic of China to the west. Corridor 3 links the Kyrgyz Republic to destinations in Western Russia to the northwest, and the Middle East and South Asia to the southeast. Within the Kyrgyz Republic, these corridors are major routes for domestic and international travel, connecting the country's northern and southern regions via the capital city of Bishkek.

4. Specifically, the project will rehabilitate various sections of the A367 road between the town of Balykchy—a major industrial and transport center at the west end of Lake Issyk-Kul—as well as the intersection between the A367 and M41 (Bishkek–Osh) roads. Various institutions are financing the upgrading of the A367 and adjacent Aral–Jalal-Abad road. The identification number, name, expected output length, financier, anticipated construction duration, and scheduled opening year of each section are summarized in Table 2.

Table 2: Key Data on Road Sections

Section	Name of the Section	Expected output	Length (km)	Financier	Scheduled Construction Start	Scheduled Construction End	Scheduled Opening
1A	Balykchy Km 0–Km 42+939	Reconstruction into Technical Category II, IRI 1.8	42.94	ADB	2018	2019	2020
	Km 42+939 – Kochkor Km 62+580	Reconstruction into Technical Category III	20.00	China Exim Bank	Construction completed	2014	2014
1B	Kochkor Km 62+580–Epkin Km 89	Reconstruction into Technical Category II, IRI 1.8	26.42	ADB	2018	2019	2020
2A	Epkin Km 89–Bashkugandy Km 159+274	Reconstruction into Technical Category II, IRI 1.8	70.27	ADB	2017	2019	2020
2B	Bashkugandy Km 159 –Kyzyl-Zhyldyz Km 183	Reconstruction into Technical Category II, IRI 1.8	23.73	IDB & SFD	2017	2018	2019
2C	Kyzyl Zhyldyz Km 183–Aral Km 195	Reconstruction into Technical Category II	12.00	China Exim Bank	Under construction	2018	2019
3A	Aral–Suusamyr Km 195–Km 260	Reconstruction into Technical Category III, IRI 1.8	65.00	EDB	2019	2021	2022
3B	Aral–Too Ashuu Km 260–Km 274+590	Reconstruction into Technical Category III, IRI 1.8	14.59	EDB	2019	2021	2022

ADB = Asian Development Bank, EDB = Eurasian Development Bank, IDB = Islamic Development Bank, IRI = international roughness index, km = kilometer, Km = distance marker, SFD = Saudi Fund for Development.
Source: ADB estimates.

5. **With-project scenario**. Given the contiguous and inseparable nature of the various investments, the economic analysis considered the viability of the entire Balykchy–Too Ashuu road. The with-project scenario involves the improvement of Sections 1A, 1B, 2A, 2B, 3A, and 3B, as described in the table above, and the subsequent routine and periodic maintenance of these sections. Section 2C and the section between Km 42+939 and Kochkor Km 62+580 are already complete or being completed using funds from the China Exim Bank, and are considered to be completed without the project.

6. **Without-project scenario**. The without-project scenario (base case) involves the routine maintenance of the existing road, including pothole patching, crack sealing, edge repairs, and other routine summer–winter maintenance. Without the project, road roughness, as measured by the international roughness index (IRI) is expected to deteriorate further. The road is expected to deteriorate to an average IRI of 16 in 5 years, rendering it unmaintainable.

B. Traffic Studies

7. The project road sections were further divided into homogeneous subsections in terms of traffic volume and composition between significant settlements and junctions. Manual classified traffic counts were conducted for each subsection, recording data on vehicle

type and nationality, direction, and travel time (hours). Traffic count results were converted into annual average daily traffic using the Kyrgyzstan Road Authority's official weekly and seasonal correlation factors. In addition, an origin–destination survey was carried out at Sosnovka village, in August 2015. Each origin–destination survey was accompanied by manual classified counts and conducted for at least 12 hours, or as long as daylight permitted. The observed annual average daily traffic for each road section is in Table 3.

Table 3: Observed Annual Average Daily Traffic

Section	Name of the Section	AADT 2015
1A	Balykchy Km 0–Km 42+939	1,009
1B and 2A	Kochkor Km 62+580 km–Epkin Km 89 and Epkin Km 89–Bashkugandy Km 159+274	1,620
2B	Bashkugandy Km 159–Kyzyl-Zhyldyz Km 183	966
2C	Kyzyl Zhyldyz Km 183–Km 195	242
3A	Aral–Suusamyr Km 195–Km 260	137
3B	Aral–Too Ashuu Km 260– Km 274+590	344

AADT = annual average daily traffic, Km = distance marker
Source: Asian Development Bank estimates.

8. Future traffic was estimated for a 25-year period (2016–2040). The growth rate for normal traffic was based on available GDP forecasts. IMF forecasts were used for 2016–2021. After this, growth was forecast to drop to 3.7% from 2022, 3.2% from 2030, and 2.8% from 2036. These adjustments reflect the uncertainty in the longer forecasts. Elasticity values were used to translate the GDP growth figures into traffic growth rates. The elasticity values used for passenger vehicles were 1.20 for 2016–2024, 1.10 for 2025–2029, and 1.05 for 2030–2040. For goods vehicles these values were 1.10 for 2016–2024, 1.05 for 2025–2029, and 1.00 for 2030–2040. It was conservatively estimated that generated traffic would add 1% to normal traffic for 10 years after the opening of each road section. Diverted traffic was considered based on the results of the origin–destination survey, as well as local knowledge of traffic circumstances. Diverted traffic was considered significant for Sections 3A and 3B, which would divert traffic from other roads traversing east and west of the country, connect the regions of Talas and Naryn.

Table 4: Forecast Annual Average Daily Traffic
(Including Generated and Diverted Traffic)

Section	2020	2025	2030	2035	2040
1A	1,573	2,078	2,601	3,052	3,522
1B and 2A	5,368	7,075	8,914	10,460	12,076
2B	4,507	5,931	7,461	8,755	10,107
2C	1,497	1,967	2,472	2,898	3,342
3A	910	2,031	2,579	3,080	3,556
3B	1,185	2,395	3,032	3,600	4,151

AADT = annual average daily traffic.
Source: Asian Development Bank estimates.

C. Economic Costs

9. The project's economic costs comprise (i) capital investment, including civil works, land acquisition and resettlement, and consulting services for construction supervision and social

safeguards management; and (ii) road maintenance.[1] Costs related to taxes, duties, and financing charges during implementation have been excluded. A breakdown of the investment costs for each road section is in Table 5.

Table 5: Financial Cost Estimate

($ million, 2016 prices)

Section	Land Acquisition and Resettlement	Civil Works	Consulting Services	Taxes	Physical Contingencies	Price Contingencies	Total
1A	-	35.84	2.49	5.20	3.58	3.94	**51.06**
1B	0.79	27.07	2.02	3.93	2.71	2.98	**38.80**
2A	0.95	71.89	6.60	10.44	7.19	7.91	**104.12**
2B	0.35	20.71	1.46	3.06	2.10	2.31	**30.00**
3	0.23	74.56	6.39	10.83	7.46	8.20	**107.46**
Total							**331.44**

Source: Asian Development Bank estimates.

10. Financial costs were converted to economic costs in line with Asian Development Bank (ADB) guidelines.[2] The economic evaluation included land acquisition and resettlement costs, civil works, consulting services, and physical contingencies, but excluded taxes, price contingencies, and financial charges during reconstruction and rehabilitation. The economic analysis was conducted based on the world price numeraire. A distinction was made between traded and non-traded goods, and a standard conversion factor of 0.914 was applied to non-traded goods. A shadow wage rate factor of 1.0 was applied for skilled labor and a factor of 0.8 was applied for unskilled labor. These factors were calculated in accordance with Appendix 12 of the Guidelines for the Economic Analysis of Projects (footnote 1).

11. Maintenance costs have been estimated at $250/km for general routine summer maintenance and $465/km for winter maintenance, plus $16 per square meter for patching potholes and cracks and $16 per square meter for periodic asphalt overlays. This expenditure is compatible with the current allocated maintenance budget and is sufficient to sustain improved road conditions for the project period. A residual value equivalent to 30% of the investment cost—estimated by applying the straight-line depreciation method to individual project items based on assumed lifespans—has been included in the economic analysis.

D. Economic Benefits

12. The incremental economic benefits considered to materialize with the project are (i) vehicle operating cost (VOC) savings, and (ii) time cost savings. Benefits were calculated separately for normal, generated, and diverted traffic. For generated traffic, the “rule of half” was applied, as per standard practice.

13. **Vehicle operating costs.** VOC savings accrue from better traffic conditions and a higher level of service on the improved road. Unit rates for VOC/km by IRI value were calculated based on the highway design and management model. The IRI values for the upgraded road are forecast to start at 1.8 at project completion, and remain at 5.0 on average at the end of the analysis. VOCs were estimated for each vehicle class at the end of 2015 using data on the price

[1] The opportunity cost of land was computed based on net agricultural output foregone.
[2] ADB. 1997. *Guidelines for the Economic Analysis of Projects.* Manila.

of new vehicles, tires, petrol, lubricating oil, crew wages, annual overhead, cargo, and maintenance costs.

14. **Time cost savings.** Travel time cost savings will result from higher permissible vehicle speeds, better alignment, an increased level of service, and easier overtaking conditions. The traffic model calculated average speeds by applying speed flow formulas that link average speeds to road type and traffic volumes. Working time values were calculated based on existing data on salaries and wages. According to data from the National Statistical Committee covering January–August 2015, the average monthly salary in the Kyrgyz Republic was Som12,617 ($196.13). This equates to $1.11 per hour based on a 22-day work month and 8-hour work day. After including the employer's 17.25% social payment, the actual average monthly salary is $229.96, or $1.31 per hour. An adjustment factor of 1.45 was applied to car passengers to allow for their relative higher incomes, and an adjustment factor of 0.5 was applied to bus passengers. The value of nonworking time was assumed to be 20% of the value of working time. Time values were assumed to increase in line with changes in forecast real GDP per capita.

15. The following average vehicle occupancy figures were derived from origin–destination surveys: 3.84 persons per car or light vehicle, 7.18 persons per small bus, and 35 persons per large bus. As the VOC unit rates include crew costs, the time savings calculation did not include any savings in terms of goods vehicle crew. It was assumed that 33% of all car occupants (including crew), 100% of passengers in light vehicles, and 70% of bus passengers were traveling for work.

16. Disruption of traffic during construction has been taken into account, and is reflected as negative value-of-time savings during 2017–2020.

E. Results of the Economic Analysis

17. An economic assessment of the project has been carried out using the standard appraisal methodology comparing the incremental benefits derived from reductions in VOCs and travel times resulting from the construction of each section against the initial investment costs and required operation and maintenance costs over the 25-year appraisal period. The results of the economic analysis are expressed in Table 6 as the following key economic indicators: the benefit–cost ratio, economic internal rate of return (EIRR), and net present value at a 12% discount rate. These results indicate that the project— overall as well as each individual road section—is economically viable. The EIRR for the entire completed corridor is 24.9%, and the net present value is $315.71 million. The economic indicators are conservative estimates as the project's impact on road safety has not been monetized due to a lack of data. Table 7 shows the stream of costs and benefits over time for the entire project.

Table 6: Result of the Economic Analysis (2016 world prices)

Section	Benefit–Cost Ratio	NPV ($ million)	EIRR (%)
1A	1.02	0.49	12.2
1B	3.35	53.07	25.4
2A	3.82	181.52	28.5
2B	3.46	55.73	30.6
3A	1.42	18.52	17.8
3B	1.65	6.35	20.6
Entire project	**2.64**	**315.71**	**24.9**

EIRR = economic internal rate of return, NPV = net present value.
Source: Asian Development Bank estimates.

Table 7: Benefit and Cost Streams
($ million, 2016 world prices, undiscounted)

Year	Capital Costs	Maintenance Costs			VOT Savings	VOC Savings
		Without Project	With Project	Incremental Change		
2017	37.53	0.16	0.00	(0.16)	(0.03)	(0.13)
2018	80.14	0.09	0.00	(0.09)	(0.12)	(0.58)
2019	83.46	0.09	0.00	(0.09)	(0.36)	(1.77)
2020	33.01	0.10	0.06	(0.04)	(5.39)	(50.89)
2021	24.76	0.10	0.06	(0.04)	13.86	79.37
2022	0.00	0.11	0.09	(0.02)	14.10	74.82
2023	0.00	0.13	0.09	(0.04)	15.52	81.38
2024	0.00	0.11	0.09	(0.02)	16.25	83.91
2025	0.00	0.12	0.09	(0.03)	16.96	86.79
2026	0.00	0.13	0.09	(0.04)	17.73	90.09
2027	0.00	0.12	0.09	(0.03)	18.56	93.76
2028	0.00	0.12	0.09	(0.03)	19.54	98.61
2029	0.00	0.14	0.09	(0.05)	20.33	102.02
2030	0.00	0.12	0.09	(0.04)	21.16	105.73
2031	0.00	0.13	34.98	34.86	22.04	109.62
2032	0.00	0.14	0.09	(0.05)	22.99	114.04
2033	0.00	0.14	0.09	(0.05)	23.99	118.92
2034	0.00	0.15	0.09	(0.06)	24.92	123.44
2035	0.00	0.13	0.09	(0.04)	25.69	126.96
2036	0.00	0.15	0.09	(0.06)	26.49	130.60
2037	0.00	0.15	0.09	(0.06)	27.29	134.20
2038	0.00	0.14	0.09	(0.05)	28.04	137.55
2039	0.00	0.15	0.09	(0.06)	28.85	141.47
2040	(52.91)	0.16	0.09	(0.07)	29.69	145.47
2041	0.00	0.01	0.03	0.02	3.56	17.64
2042	(24.76)	0.01	0.03	0.02	3.66	18.15
					EIRR	**24.90%**
					NPV	**315.71**

( ) = negative, EIRR = economic internal rate of return, NPV = net present value, VOC = vehicle operating cost, VOT = value of time.
Source: Asian Development Bank estimates.

18. Sensitivity tests were carried out and switching values were calculated to determine the effect of variations in key input parameters on the key economic indicators. The results are described in Table 8. Overall, the project was found to be robust against increased construction costs and lower traffic. One scenario considered the lack of timely provision of maintenance funds (no periodic maintenance after 2024, which would quicken the deterioration of the road's surface quality and lower residual value). In this scenario, the EIRR drops to 24.3%, highlighting the importance of timely maintenance. In summary, the economic analysis was undertaken in line with ADB guidelines. The project has an EIRR above 12% and is therefore economically viable.

Table 8: Result of the Sensitivity Analysis
(2016 world prices)

Scenario	Benefit–Cost Ratio	NPV ($ million)	EIRR (%)	Switching Value (%)
Base case	2.64	315.71	24.9	N/A
Construction cost + 10%	2.40	297.01	23.4	168
Vehicle operating cost savings - 10%	2.54	287.44	23.9	-75
Travel time cost savings - 10%	2.59	307.16	24.6	N/A
Traffic lower - 20%	2.14	214.52	21.3	N/A
Lack of maintenance funds	2.41	263.45	24.3	N/A

EIRR = economic internal rate of return, N/A = not applicable, NPV = net present value.
Source: Asian Development Bank estimates.

F. Results of Financial Analysis

19. The MOTR maintains roads within their jurisdiction through nine regional road maintenance offices, which undertake maintenance work on an ad hoc basis using force account. During 2007–2010, funding covered annually planned roadworks and eliminated part of the backlog of previous years. Table 9 shows the funds allocated for road maintenance over the past 10 years. Absolute resources (in som) have generally remained constant; however, the sharp increase in the price of fuel and bitumen (by 38% on average) significantly reduced the number of roadworks that can be undertaken. The recent devaluation of the som further contributed to this trend. In the last 3 years, funding has remained stable at 1.71–1.80% of the national budget, or approximately Som1.8 billion per year. Regional corridors are prioritized.

Table 9: Budgetary Allocation to the Road Sector 2005–2016

Year	National Budget (Som million)	Funds for Road Maintenance in the National Budget (Som million)	Share of Road Maintenance Funding of the National Budget (%)	$/Som Exchange Rate	Funds for Road Maintenance ($ million)
2005	16,813.40	221.70	1.32	41.01	5.41
2006	20,478.90	410.20	2.00	40.13	10.22
2007	34,136.70	1,058.80	3.10	37.27	28.41
2008	44,698.60	1,564.50	3.50	36.60	42.75
2009	48,105.80	1,655.10	3.44	42.92	38.56
2010	65,666.00	1,552.50	2.36	46.00	33.75
2011	86,099.60	1,344.37	1.56	46.12	29.15
2012	101,521.70	1,684.70	1.66	47.00	35.84
2013	96,679.70	1,846.79	1.91	48.44	38.12
2014	102,899.20	1,730.74	1.68	53.65	32.26
2015	107,657.30	1,792.84	1.67	64.46	27.81
2016	146,853.41	1,741.60	1.19	67.40	25.84

Source: Ministry of Transport and Roads.

20. Incremental maintenance costs associated with the project sections are estimated to total $33.68 million (undiscounted) for 2020–2040 (see Table 7). The government has committed to maintaining a road maintenance budget similar to that of the previous 5 years. It is thus reasonable to expect that funds will be available to meet the project road's maintenance costs.

21. The project will also improve the maintenance of the entire road network by implementing a road asset management system, which will (i) help the MOTR prepare optimized maintenance budgets and (ii) support sufficient budgetary allocations for planned road maintenance.

22. To improve road maintenance, ADB is helping the government develop its road asset management plan to ensure that sufficient funds are allocated to maintain the existing network. ADB is supporting the introduction of performance-based maintenance contracts and running pilot schemes in the country. ADB will continue to coordinate with other donor partners with experience in road asset management in the Kyrgyz Republic, including the European Bank for Reconstruction and Development, Japan International Cooperation Agency, and the World Bank. With these development partners, ADB will help develop and expand the computer-based road management system and support road sector reform by strengthening sustainability and resource allocation for road maintenance.

23. There are several opportunities to generate more maintenance funding. Traditional sources such as vehicle licensing and registration fees must be brought in line with the actual value and usage of the vehicles. Fees from foreign vehicles entering or transiting the Kyrgyz Republic and tolls on certain parts of the network are also possible. Unit maintenance costs may be reduced by revising design standards, materials, and equipment, while procurement can be improved to ensure and encourage the development of national private contractors, increase competition, and lower costs.