ECONOMIC AND FINANCIAL ANALYSIS

A. Introduction

1. The economic viability of the three core project roads (Alicia–Malangas, Tampilisan–Sandayong, and Lutiman–Guicam–Olutanga) was assessed. The project will improve the condition of these roads by replacing the gravel surface with a concrete pavement.

B. Traffic Forecast

2. Traffic counts for the core project roads and origin–destination surveys in the project area were conducted during the project preparatory technical assistance to serve as the basis for the traffic forecast (Table 1). Forecasts by traffic and vehicle type were prepared for the project roads for 2017–2040. The core roads are located in rural areas of the Zamboanga peninsula in Region IX of the Philippines. The growth rates used for the traffic forecast are based on forecast population growth and gross regional domestic product in the region (Table 2). The same traffic growth rates are used for all three roads. Forecast traffic consists of normal and generated traffic and is shown in Table 3.

Table 1: Actual Traffic on Core Roads
(vehicles per day 2015)

	Heavy Truck	Medium Truck	Small Truck	Large Bus	Medium Bus	Minibus	Pickup	Car/ SUV	Motorcycle	Total
Alicia–Malangas	4	71	41	0	2	12	28	10	3,208	**3,376**
Tampilisan–Sandayong	0	36	133	1	0	22	35	46	2,402	**2,675**
Lutiman–Guicam	8	69	199	0	3	103	298	360	3,324	**4,363**

Source: *Technical Assistance to the Philippines for Improving National Roads for Inclusive Growth in Mindanao* (TA 8574-PHI) consultants.

Table 2: Region IX Forecast Data
(annual growth rates)

Item	2015–2020	2020–2025	2025–2030	2030–2035	2035–2040
Population[a]	1.80	1.56	1.35	1.16	0.93
Regional GDP/capita[b]	4.50	4.80	5.00	5.00	5.00

GDP = gross domestic product.
Sources: Philippines Statistics Authority. 2010. Census based medium projection. Manila; Philippines-IHS Global Insight. May 2015.

Table 3: Traffic Growth Rates, 2017–2040
(% per annum)

Vehicle Type	2017–2020	2020–2025	2025–2030	2030–2035	2035–2040
Heavy truck	4.8	5.8	6.8	7.3	7.8
Medium truck	4.5	4.8	4.6	4.2	3.8
Small truck	4.5	5.1	5.7	5.8	5.8
Large bus	4.8	4.8	4.6	4.2	3.4
Medium bus	4.5	4.2	3.5	3.1	2.6
Mini bus	4.8	4.8	4.6	4.2	3.4
Pickup	5.0	6.1	7.2	8.1	9.1
Car/SUV	5.0	6.1	7.2	8.1	9.1
Motorcycle	4.0	3.5	2.8	2.3	1.7

Source: Asian Development Bank.

C. Economic Analysis

3. The economic analysis for the core roads compares the with- and without-project scenarios. In the without-project scenario, the roads are assumed to remain in their present condition, which is a gravel surface of fair to bad condition. The with-project scenario includes the construction of concrete roads with routine and periodic maintenance according to international standards. The project preparatory technical assistance considered various mutually exclusive project alternatives, such as different pavement types, and the project is based on the most cost-effective and least-cost option. The economic analysis covers 23 years (2018–2040), based on a 3-year implementation period. All benefits and costs are in constant 2017 prices. The economic prices are expressed using the domestic price numeraire.

4. **Costs.** Project economic costs for each road are based on project costs attributable to each road including construction, maintenance, supervision consulting services, land acquisition and resettlement, and physical contingencies. Taxes and duties, price contingencies, and interest during construction are excluded. Costs are divided into tradable and non-tradable portions. A shadow exchange rate factor of 1.1 was applied to the tradable portion. To take into account local unemployment and underemployment, costs for unskilled labor were adjusted by a shadow wage rate factor of 0.7 to arrive at the economic opportunity cost.

5. **Benefits.** Three main benefits were identified and estimated for inclusion in the economic viability assessment of the core roads: (i) reduced vehicle operating costs, (ii) savings from reduced transport time, and (iii) generated traffic. Benefits were valued using the same methodology as for costs. The combined economic vehicle operating cost (VOC) and passenger time cost by vehicle type and road surface condition with and without the project are shown in Table 2. The values for VOCs and time are based on the Department of Public Works and Highways (DPWH) estimates, adjusted for inflation.[1] Time savings provide 35% of benefits in the first year of operations. This proportion increases during the implementation period in accordance with the forecast growth in real gross regional domestic product. Benefits for generated traffic are valued at half the value of benefits of normal traffic.

Table 4: Unit Rates for Combined Vehicle Operating and Time Costs
($/kilometer)

Road Condition	Truck	Bus	Minibus	Pickup	Car	Motorcycle
With project paved good	0.77	0.72	0.36	0.25	0.38	0.07
Without project gravel fair	1.22	1.07	0.52	0.38	0.56	0.12
Without project gravel bad	1.45	1.45	0.72	0.49	0.76	0.18

Source: Asian Development Bank and Department of Public Works and Highways estimates.

6. **Results of economic analysis.** The economic internal rate of return of the three core project roads ranges from 10.4% to 19.1%, and the net present value ranges from $2.0 million to $37.0 million, using a 9.0% discount rate (Tables 5–7). In addition to the quantified benefits, communities in the areas of influence will benefit indirectly through improved connectivity with better access to markets, economic opportunities, and government and other social services such as education and health, and improved security.

[1] Department of Public Works and Highways (DPWH). 2008. *Planning Service Methodology on Validation of Travel Time.* Manila.

Table 5: Economic Internal Rate of Return for Alicia–Malangas Road
($ million)

	Costs				Benefits		
Year	Capital Costs	Maintenance Costs	Total Costs	VOC and Time Savings	Generated Traffic	Total Benefits	Net Benefits
2018	5.33		5.33			0.00	(5.33)
2019	13.33		13.33			0.00	(13.33)
2020	8.00		8.00			0.00	(8.00)
2021	0.00	0.03	0.03	2.99	0.30	3.29	3.25
2022	0.00	0.03	0.03	3.11	0.31	3.42	3.39
2023	0.00	0.03	0.03	3.22	0.32	3.54	3.51
2024	0.00	0.03	0.03	3.34	0.33	3.68	3.64
2025	0.00	0.03	0.03	3.47	0.35	3.81	3.78
2026	0.00	0.03	0.03	3.59	0.36	3.95	3.92
2027	0.00	0.03	0.03	3.73	0.37	4.10	4.07
2028	0.00	0.03	0.03	3.85	0.38	4.23	4.20
2029	0.00	0.03	0.03	3.97	0.40	4.36	4.33
2030	0.00	0.03	0.03	4.09	0.41	4.50	4.47
2031	0.00	0.03	0.03	4.22	0.42	4.65	4.61
2032	0.00	0.03	0.03	4.36	0.44	4.79	4.76
2033	0.00	0.03	0.03	4.48	0.45	4.93	4.90
2034	0.00	0.03	0.03	4.60	0.46	5.06	5.03
2035	3.02	0.03	3.05	4.73	0.47	5.21	2.15
2036	0.00	0.03	0.03	4.87	0.49	5.35	5.32
2037	0.00	0.03	0.03	5.00	0.50	5.50	5.47
2038	0.00	0.03	0.03	5.12	0.51	5.64	5.60
2039	0.00	0.03	0.03	5.25	0.53	5.78	5.74
2040	(1.51)	0.03	-1.48	5.38	0.54	5.92	7.40
						EIRR	**12.2%**
						NPV	**6.70**

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

Table 6: Economic Internal Rate of Return for Tampilisan–Sandayong Road
($ million)

	Costs				Benefits		
Year	Capital Costs	Maintenance Costs	Total Costs	VOC and Time Savings	Generated Traffic	Total Benefits	Net Benefits
2018	3.94		3.94			0.00	(3.94)
2019	9.84		9.84			0.00	(9.84)
2020	5.91		5.91			0.00	(5.91)
2021	0.00	0.02	0.02	1.86	0.19	2.05	2.02
2022	0.00	0.02	0.02	1.94	0.19	2.13	2.11
2023	0.00	0.02	0.02	2.02	0.20	2.22	2.19
2024	0.00	0.02	0.02	2.10	0.21	2.31	2.28
2025	0.00	0.02	0.02	2.18	0.22	2.40	2.38
2026	0.00	0.02	0.02	2.27	0.23	2.50	2.47
2027	0.00	0.02	0.02	2.36	0.24	2.60	2.57
2028	0.00	0.02	0.02	2.45	0.25	2.70	2.67
2029	0.00	0.02	0.02	2.54	0.25	2.80	2.77
2030	0.00	0.02	0.02	2.64	0.26	2.90	2.88
2031	0.00	0.02	0.02	2.74	0.27	3.01	2.99
2032	0.00	0.02	0.02	2.84	0.28	3.13	3.11
2033	0.00	0.02	0.02	2.95	0.29	3.24	3.22
2034	0.00	0.02	0.02	3.05	0.31	3.36	3.33
2035	2.93	0.02	2.95	3.16	0.32	3.47	0.52
2036	0.00	0.02	0.02	3.27	0.33	3.60	3.57

	Costs			Benefits			
Year	Capital Costs	Maintenance Costs	Total Costs	VOC and Time Savings	Generated Traffic	Total Benefits	Net Benefits
2037	0.00	0.02	0.02	3.39	0.34	3.73	3.70
2038	0.00	0.02	0.02	3.51	0.35	3.86	3.84
2039	0.00	0.02	0.02	3.63	0.36	4.00	3.97
2040	(1.46)	0.02	(1.44)	3.77	0.38	4.14	5.59
						EIRR	**10.4%**
						NPV	**2.07**

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

Table 7: Economic Internal Rate of Return for Lutiman–Guicam–Olutanga Road
($ million)

	Costs			Benefits			
Year	Capital Costs	Maintenance Costs	Total Costs	VOC and Time Savings	Generated Traffic	Total Benefits	Net Benefits
2018	7.43		7.43			0.00	(7.43)
2019	18.57		18.57			0.00	(18.57)
2020	11.14		11.14			0.00	(11.14)
2021	0.00	0.05	0.05	6.26	0.63	6.89	6.83
2022	0.00	0.05	0.05	6.54	0.65	7.19	7.14
2023	0.00	0.05	0.05	6.85	0.68	7.53	7.48
2024	0.00	0.05	0.05	7.17	0.72	7.89	7.84
2025	0.00	0.05	0.05	7.51	0.75	8.26	8.21
2026	0.00	0.05	0.05	7.87	0.79	8.66	8.61
2027	0.00	0.05	0.05	8.25	0.82	9.07	9.02
2028	0.00	0.05	0.05	8.65	0.87	9.52	9.47
2029	0.00	0.05	0.05	9.08	0.91	9.99	9.94
2030	0.00	0.05	0.05	9.54	0.95	10.49	10.44
2031	0.00	0.05	0.05	10.02	1.00	11.02	10.97
2032	0.00	0.05	0.05	10.53	1.05	11.58	11.53
2033	0.00	0.05	0.05	11.08	1.11	12.19	12.13
2034	0.00	0.05	0.05	11.65	1.17	12.82	12.76
2035	6.45	0.05	6.50	12.26	1.23	13.49	6.98
2036	0.00	0.05	0.05	12.91	1.29	14.20	14.15
2037	0.00	0.05	0.05	13.60	1.36	14.96	14.91
2038	0.00	0.05	0.05	14.37	1.44	15.81	15.75
2039	0.00	0.05	0.05	15.20	1.52	16.72	16.67
2040	(3.23)	0.05	(3.17)	16.09	1.61	17.70	20.87
						EIRR	**19.1%**
						NPV	**36.99**

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

7. **Sensitivity analysis.** This analysis was carried out to test the effects of negative changes in key parameters that determine the project benefits and costs (Tables 8–10). Four scenarios were tested: increase in total costs by 10%, decrease in total benefits by 10%, increase in total costs by 10% and decrease in total benefits by 10%, and delay in implementation by 1 year. The results exceed the Asian Development Bank threshold of 9.0% in all cases for all three roads with the exception of the combined increase in total costs and decrease in total benefits for the Tampilisan–Sandayong road. Switching values were calculated for the increase in costs and decrease in total benefits. In the worst case for the three roads, the analysis indicates that total costs would have to increase by 12% or total benefits decrease by 11.0% for the EIRR to reach 9.0%. For the other two roads, the switching values are significantly higher. Such changes are

not expected to occur as the detailed design has been completed and the roads are not difficult technically.

Table 8: Sensitivity Analysis (Alicia–Malangas)

Item	EIRR (%)	ENPV ($ million)	Switching Value (%)
Costs increase (10%)	10.9	4.40	29
Benefits decrease (10%)	10.8	3.70	23
Costs increase by 10% and benefits decrease by 10%	9.7	1.44	
Implementation delay of 1 year	11.8	5.85	

EIRR = economic internal rate of return, ENPV = economic net present value.
Sources: Asian Development Bank and technical assistance consultant estimates.

Table 9: Sensitivity Analysis (Tampilisan–Sandayong)

Item	EIRR (%)	ENPV ($ million)	Switching Value (%)
Costs increase (10%)	9.2	0.37	12
Benefits decrease (10%)	9.1	0.16	11
Costs increase by 10% and benefits decrease by 10%	8.0	(1.54)	
Implementation delay of 1 year	10.1	1.65	

EIRR = economic internal rate of return, ENPV = economic net present value.
Sources: Asian Development Bank and technical assistance consultant estimates.

Table 10: Sensitivity Analysis (Lutiman–Guicam–Olutanga)

Item	EIRR (%)	ENPV ($ million)	Switching Value (%)
Costs increase (10%)	17.6	33.75	115%
Benefits decrease (10%)	17.5	30.05	53%
Costs increase by 10% and benefits decrease by 10%	16.1	26.82	
Implementation delay of 1 year	18.6	34.71	

EIRR = economic internal rate of return, ENPV = economic net present value.
Sources: Asian Development Bank and technical assistance consultant estimates.

D. Financial Analysis

8. Financial resources for the development and maintenance of roads come from various sources, including loans and credits, general government revenue, and an extra-budgetary fund dedicated largely to road maintenance. The fund is financed from the Motor Vehicle User's Charge, a road user tax collected in connection with the registration of all motor vehicles. The general budget provides the majority of funds for road maintenance.

9. The DPWH follows a systematic approach prepares budget requests for maintenance of national roads. The DPWH conducts assessments of road condition and uses the data in its Pavement Management System, Routine Maintenance Management System, and eventually in the Multi-Year Programming System to formulate the budget request. The DPWH uses the Highway Development and Management model (HDM-4) to prioritize the use of the funds allocated in the budget. The DPWH is undertaking efforts to improve maintenance of national roads. The DPWH issued a Department Order in November 2015 on Policy Guidelines on the Maintenance of National Roads and Bridges superseding existing department orders on this topic.[2] The Department Order specifies detailed policy guidelines on the maintenance of national

[2] DPWH Department Order No. 171, November 2015.

roads and bridges, descriptions of defects and deficiencies and response times, and sanctions and rewards.

10. Financial analysis shows that the funding for maintenance of national roads in the Philippines has increased significantly since 2010. Funding for routine maintenance increased at an average annual growth rate of about 25% from 2010 to 2017. Funding for more intensive maintenance and rehabilitation, reconstruction, and upgrading of national roads stayed at about the same level in 2017 as 2011; however, funding for these activities increased at an average annual growth rate of about 16% from 2015 to 2017 (Table 11). Maintenance of the improved roads with their concrete pavement will be less expensive than maintenance of the roads with their current gravel surface. The cost of maintaining the 280 kilometers of roads to be improved under the project is estimated at ₱21 million per year. Maintenance for the project roads will be financed by expenditures of the DPWH, appropriated in the national budget, and executed by local DPWH offices. Based on the trend of increasing funding for maintenance of national roads and the lower funding requirement for maintaining the improved project roads, it is considered reasonable to expect that the government will provide sufficient financing for the maintenance of the project roads and that the project is financially sustainable.

Table 11: Approved Allocations for Maintenance and Improvement of National Highways

	Routine Maintenance (₱ million)	% Change	Preventive Maintenance[a] (₱ million)	% Change	Rehabilitation/ Reconstruction/ Upgrading (₱ million)	% Change	Total (₱ million)	% Change
2011	4,000		3,933		18,224		26,157	
2012	5,500	37.5	7,591	93.0	13,033	-28.5	26,124	-0.1
2013	4,001	-27.3	14,253	87.8	7,822	-40.0	26,076	-0.2
2014	6,590	64.7	7,460	-47.7	9,944	27.1	23,994	-8.0
2015	6,700	1.7	464	-93.8	16,326	64.2	23,490	-2.1
2016	8,500	26.9	5,076	994.0	15,782	-3.3	29,358	25.0
2017	10,000	17.6	5,380	6.0	17,055	8.1	32,435	10.5
2018[b]	11,000	10.0	16,400	204.8	21,501	26.1	48,901	50.8

( ) = negative.
[a] Includes periodic maintenance and other non-routine maintenance.
[b] Proposed 2018 Government of the Philippines budget
Sources: National Expenditure Program of the Department of Public Works and Highways. Department of Budget and Management, Republic of the Philippines.