ECONOMIC AND FINANCIAL ANALYSIS

A. Macroeconomic and Sector Context

1. Viet Nam's economy has grown at a robust pace of 5.8% a year from 2010 to 2015,[1] and is forecast to grow at a rate of 6.0% a year from 2016 to 2020, in a context of improved macroeconomic stability.[2] The gross domestic product (GDP) per capita reached $2,040 in 2014 ($5,294 at purchasing power parity).[3]

2. Since 2004 at least, the transport sector has grown at a faster pace than the rest of the Vietnamese economy, as motorization rates have increased and the government has dedicated increasingly large resources to capital investments in the sector. Motorization rates increased by 13.5% a year from 2004 to 2012, about two times faster than GDP growth.[4] Investments in the transport sector in Viet Nam reached 4.5% of GDP in 2009, the majority (3.6% of GDP) of which went toward the road sector.[5]

3. The province of Thanh Hoa, a predominantly agricultural region with a population of 3.4 million, is experiencing a phase of economic catch-up with the rest of Viet Nam. From a very low base, the province's GDP has grown annually at two-digit rates since 2004, growing 11.6% in 2014 to reach a GDP per capita of $1,365. The districts of Ba Thuoc and Cam Thuy, through which the project road crosses, are less developed than the rest of the province, as they are less densely populated and industrialized. In 2014, annual incomes per capita in 2014 ranged from $600 to $1,000, and had been growing at 11%–15% per year.

4. This fast economic growth is exerting pressure on the province's transport infrastructure. For instance, the project road was built in 2001–2005 as a low-standard (class IV) mountainous rural road.[6] However, from 2009 to 2014, traffic along the project road grew by about 18% annually, making the original design no longer appropriate to the new situation. For a long time, Viet Nam did not invest enough in road maintenance, which led to a degradation of the road surfaces in the country. Since 2012, when the government created a road maintenance fund, it has increased maintenance spending. Resources are now generally sufficient, but there remains a large backlog of roads needing rehabilitation and upgrading.[7]

B. Project Rationale

5. The project road is a segment of the Greater Mekong Subregion Northeastern Transport Corridor, which extends from Thanh Hoa in Viet Nam through northern Lao People's Democratic Republic (PDR) to Bangkok, Thailand. The original project targeted selected sections of routes 6, 6A, and 6B in the Lao PDR totaling 143 kilometers (km), and a 196 km section of Highway 217 in Viet Nam. The original project in Viet Nam covered (i) the rehabilitation and upgrading of 88.2 km between Na Meo, at the border with the Lao PDR, and km 107.2, (ii) construction of

---

[1] Asian Development Bank (ADB). 2015. *Asian Development Outlook 2015: Financing Asia's Future Growth*. Manila.
[2] International Monetary Fund. 2015. *World Economic Outlook Database April 2015*. Washington, DC.
[3] World Bank. 2015. *East Asia Pacific Economic Update April 2015*. Washington, DC.
[4] Greater Mekong Subregion (GMS) Core Environment Program. GMS Statistics, Vehicle motorization index. http://www.gms-eoc.org/gms-statistics/overview/vehicle-motorization-index (accessed 22 April 2015).
[5] ADB. 2012. *Viet Nam: Transport Sector Assessment, Strategy, and Road Map*. Manila.
[6] Vietnam's road design standards refer to two expressway classes and six road classes (I to VI). A Class IV is indicated for less than 1,000 vehicles, and has a design speed of 40 kph.
[7] World Bank. 2013. *Project Appraisal Document for the Vietnam Road Asset Management Project*. Washington, DC.

new bypasses of Cam Thuy, and (iii) e pavement repairs and resurfacing on the rest of the corridor (km 0 to km 104.475).[8]

6. Since 2010 traffic has more than doubled, while road conditions have deteriorated on the 45 km highway segment between the towns of Cam Thuy (km 59.9) and Ba Thuoc (km 104.475). As simple maintenance works can no longer meet needs, the government has prioritized the rehabilitation and upgrading of the segment. Also, at the road origin (at km 0, at Ha Trung town, near Thanh Hoa city), Highway 217 intersects at grade with Highway 1, which is the north–south backbone of Viet Nam's transport network, and crosses a major railway line. At current traffic levels, this intersection's design standards are now too low, and this causes congestion and unsafe conditions. The government has prioritized its improvement through grade segregation and the addition of a flyover above the railway line.

7. The project road between Cam Thuy and Ba Thuoc is currently a narrow rural road of 5.5 meters (m) to 6.5 m in width (5.7 m average), set over a 7 m wide formation. The road has a bituminous surface in fair to very poor condition. There are frequent pavement defects, such as deep and uneven depressions, patches, corrugations, and occasional potholes. While some pavement segments are still in fair condition, the pavement on other segments has disintegrated. The average roughness of the road, based on the International Roughness Index (IRI), was estimated through visual surveys to be about 9 (in the 7–12 range), which indicates a need for rehabilitation rather than maintenance. The alignment has low standards, comprising 58 horizontal curves of less than 125 m radius, and about 9 km that is subject to periodic flooding of up to 2 m depth from the nearby Ma River. Design speed is 40 kilometers per hour (kph), but because of the poor surface condition, speeds for the heavier vehicles can go as low as 20 kph in difficult sections.

8. Survey carried out in 2014 by the government for the preparation of this additional financing show that traffic between Cam Thuy and Canh Nang reaches 7,729 vehicles a day, and 4,837 vehicles a day between Canh Nang and Ba Thuoc. While most of the vehicles on the road are motorcycles (85%, a level commonly seen in Viet Nam), four-wheeled vehicle traffic (cars, trucks, and buses) has increased at 15%–25% a year since 2012. Highway 1 is a major throughway, with traffic at Ha Trung of 21,150 vehicles a day (14,080 four-wheeled vehicles). At the intersection of Highway 217 and Highway 1, the level of service is estimated to be D (on a scale going from A to F, A denoting free-flow, and C being the minimum normally used as long-term design target).[9]

9. A lasting and sustainable improvement of the surface, width, and alignment of the road segment between Cam Thuy and Ba Thuoc , and an improvement of the junction with Highway 1 would facilitate the movement of people and goods between Viet Nam and the Lao PDR, as well as along Viet Nam's main north–south road corridor.

C. Project Definition and Option Analysis

10. Several options to improve the road segment and the junction were considered. A simple resurfacing is no longer possible, while rehabilitation would give a short-term improvement but would fail to address the capacity limitations of the road and the poor alignment. A level of

[8] ADB. 2010. *Report and Recommendations of the President to the Board of Directors: Proposed Loan, Grant, and Administration of Loan Lao People's Democratic Republic and Socialist Republic of Viet Nam: Second Northern Greater Mekong Subregion Transport Network Improvement Project*. Manila

[9] The level of service is a qualitative performance measure of traffic flow. Transportation Research Board. 2010. *Highway Capacity Manual (Fifth Edition)*. Washington, DC.

service analysis was also used to determine the preliminary design for the interchange with Highway 1. Upgrading the road segment to Viet Nam class III (mountainous road) was found to meet the minimal requirements for an international corridor while ensuring a C level of service for 20 years of operation, which is the design objective (Footnote 9). To achieve a similar C level of service for a twenty years horizon at the intersection of Highway 217 and Highway 1, a trumpet type interchange followed by a 1.6 km new road segment and a 372 m flyover above the rail line is the most appropriate technical solution.[10]

11. For the purpose of the economic analysis, the without-project case considers that the current maintenance strategy is extended indefinitely. In this counterfactual scenario, the government would maintain the current road through routine maintenance (at $1,000 per km annually), patching, and periodic maintenance such as resealing. This strategy would only prevent a complete breakdown of the road. Allowing for the growth of traffic and impact of time on the structures, it was estimated that the surface of the road would remain very poor (average IRI of 9) under this strategy.

12. The project considered is for the complete reconstruction of the road to a width of 6 m (two 3 m lanes), and the adjunction of 1 m paved shoulders and 0.5 m gravel ones. Based on projected traffic loading, a flexible pavement with a 12-centimeter asphalt concrete surface was chosen on most of the alignment, except for sections subject to flooding, which will receive a rigid concrete pavement. Pavement design life is 10 years. The maintenance strategy considered in the with-project case includes annual routine maintenance (at $3,000 per km), and an asphaltic overlay every 10 years. Altogether, the roughness of the project road is estimated to remain good to excellent (average IRI of 3).

D. Traffic Forecasts

13. The traffic baseline was determined on the basis of the government's monthly traffic counts at two points on the road for 2012, 2013, and 2014, and confirmed with a 3-day, 24-hour classified traffic count in 2014. A 3-day origin–destination survey was also carried out in 2014 at three points near the intersection of Highway 217 and Highway 1.[11] Traffic growth forecasts assume that (i) Viet Nam maintains a 6% rate of growth until 2025, (ii) Thanh Hoa Province's GDP growth rate keeps outperforming the national average as it catches up with the rest of Viet Nam, and (iii) car ownership steadily increases. Traffic on the project road is projected to grow between 2015 and 2035 at a rate of 3.0%–3.5% annually, including a 7%–10% annual increase in four-wheeled vehicles and a 1%–2% annual growth rate in motorcycle use. Four-wheeled traffic on Highway 1 is assumed to grow at about half the rate as on Highway 217, reflecting national economic trends. The improvement of the project road is not expected to lead to significant traffic generation or diversion of traffic from other itineraries or modes of transport.

Table 1: Summary Traffic Forecasts
(Annual average daily traffic)

	Highway 217 Cam Thuy–Canh Nang			Highway 217 Canh Nang–Ba THuoc			Highway 1 at Ha Trung		
Vehicle Type	**2014**	**2020**	**2038**	**2014**	**2020**	**2038**	**2014**	**2020**	**2038**
Motorcycles	6,675	8,350	9,988	4,104	5,134	6,140	7,071	8,298	9,077
Cars	262	585	2,565	163	364	1,593	4,170	6,599	14,022

[10] A trumpet interchange is used where one highway terminates at another highway. It involves at least one loop ramp connecting the terminating highway with the continuous highway.

[11] Yooshin Engineering Co. 2015. *Preparing the Second Greater Mekong Subregion Transport Network Improvement Project – Highway No 217 – Phase 2*. Ha Noi.

	Highway 217 Cam Thuy–Canh Nang			Highway 217 Canh Nang–Ba THuoc			Highway 1 at Ha Trung		
Vehicle Type	**2014**	**2020**	**2038**	**2014**	**2020**	**2038**	**2014**	**2020**	**2038**
Light truck	286	484	1,449	196	334	1,004	2,114	2,836	5,069
Medium truck	183	310	1,100	127	216	765	1,967	2,638	5,345
Heavy truck	71	116	414	58	94	337	1,489	1,930	3,911
Articulated truck	34	56	199	34	56	199	1,875	2,432	4,924
Medium bus	97	194	688	66	132	465	999	1,486	2,827
Large bus	121	240	847	89	177	623	1,468	2,185	4,156
Total without motorcycles	**1,054**	**1,985**	**7,262**	**733**	**1,373**	**4,986**	**14,082**	**20,106**	**40,254**
Total	**7,729**	**10,335**	**17,250**	**4,837**	**6,507**	**11,126**	**21,153**	**28,404**	**49,331**

Source: Asian Development Bank estimates.

E. Cost–Benefit Analysis

14. **Project costs.** The project's additional financing capital economic costs total $52.4 million ($41.2 million for the project road, and $11.2 million for the interchange with flyover). These costs include the civil works, supervision, management, utility relocation, environmental mitigation, land opportunity costs, and resettlement. Economic costs were derived from financial costs by removing financial contingencies, financing costs, and taxes and duties, and by applying a standard conversion factor of 0.98 to local costs.[12] The analysis uses the world numeraire and a base year of 2014. Low-skilled labor was shadow priced using a shadow labor rate factor of 0.9.

15. **Reduction in vehicle operating costs**. The improvement of the pavement will lead to an average reduction of vehicle operating costs by 17%. Vehicle operating costs were determined with the equations of the Highway Development and Management software, on the basis of parameters described in Table 2.

Table 2: Main Vehicle Fleet Parameters and Operating Costs

Road Vehicle Fleet	**Motor-cycle**	**Car**	**Medium Bus**	**Large Bus**	**Light Truck**	**Medium Truck**	**Heavy Truck**	**Articulated Truck**
Economic Unit Costs ($)								
New vehicle cost/vehicle	480	15,520	27,630	75,630	14,040	32,610	59,270	75,630
Fuel cost/liter	0.68	0.68	0.61	0.61	0.61	0.61	0.61	0.61
New tires (per tire)	0	60	160	167	130	153	167	167
Maintenance labor cost/hour	1.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Crew cost/hour			1.22	1.70	1.14	1.36	1.85	1.85
Utilization								
Kilometers driven/year	12,000	15,000	40,000	60,000	28,000	28,000	28,000	40,000
Hours driven/year	450	500	1,000	1,200	1,200	1,200	1,200	1,600
Service life (years)	6	10	10	10	8	10	10	12

Source: Asian Development Bank estimates.

16. **Reduction in travel time costs**. The improvement of the road width and pavement will reduce congestion and allow for higher speeds. Without the project, average vehicle speeds would fall from about 40 kph to about 20 kph–25 kph by 2040, as congestion would rise on this narrow road. After the upgrading, average speeds of 60 kph are expected. The value of passengers' time was estimated to be on average $0.60 per hour.[13] Unit values were taken to rise in line with real GDP per capita.

[12] Land opportunity cost was valued based on the value of lost agricultural production over 20 years. Resettlement costs include reconstruction costs but not additional cash assistance, which is considered to be a financial transfer.

[13] Based on actual wage rates at shadow prices in the project area. Different assumptions were used for car and non-car users and for working and non-working time.

17. **Flyover evaluation**. The interchange and flyover will improve traffic flow at the junction of Highway 217 and Highway 1, reducing congestion on both roads. A capacity and delay analysis showed that average delays at the junction had already reached 55 seconds per vehicle (level of service D) in 2015 and would drastically increase to reach 10 minutes per vehicle by 2040. The junction should enable a C level of service (i.e., a less than 40-second delay per vehicle) over the 25-year period of evaluation. However, the flyover will also require vehicles to drive over an additional 2 km road segment, which will marginally increase their vehicle operating costs and time.

18. **Reduction in road crashes**. The wider road pavement and shoulders will help better segregate slow- and fast-moving vehicles. The positive effects on road safety may be offset by the higher vehicle speeds. The impact on the project road on the number and frequency of road crashes is expected to remain minor and was neglected. The interchange at the junction of Highway 217 and Highway 1 will improve safety by removing the need for turning traffic to cross through lanes moving in the other direction at fast speed. It was not possible to evaluate the impact of the interchange on road crashes because of a lack of localized data.

19. **Cost–benefit analysis.** The economic interest rate of return (EIRR) of the project's additional financing scope is 14.9%, with a net present value of $12.5 million at a 12% discount rate (Table 3). The project road upgrade between Cam Thuy and Ba Thuoc has an EIRR of 15.1%, and the interchange with flyover has an EIRR of 14.6%.

F. Risk and Sensitivity

20. The project's viability can withstand moderate negative impacts, such as an increase in capital costs of 20% (EIRR of 12.9%), a reduction of benefits by 20% (EIRR of 12.5%), a 2-year delay in project implementation (EIRR of 13.5%), or a combination of a 10% increase in costs, a 10% decrease in benefits, and 1-year delay (EIRR of 12.1%). Costs would have to increase by 31% or benefits would have to decrease by 24% for the EIRR to fall below 12%.

Table 3: Cost–Benefit Analysis Summary
($ million)

	Capital Costs		Operation and	Benefits		
Year	Road Upgrade	Interchange	Maintenance	Road Upgrade	Interchange	Net Benefits
2016	4.1	1.1				(5.2)
2017	18.5	5.0				(23.6)
2018	18.5	5.0				(23.6)
2019			0.1	4.7	(0.3)	4.3
2020			(1.2)	5.1	(0.2)	6.1
2021			0.1	5.4	(0.0)	5.3
2022			0.1	5.8	0.2	5.9
2023			0.1	6.2	0.4	6.5
2024			0.1	6.7	0.7	7.3
2025			(1.2)	7.2	1.1	9.5
2026			0.1	7.7	1.5	9.1
2027			0.1	8.2	2.0	10.1
2028			0.1	8.7	2.5	11.1
2029			4.5	9.3	3.3	8.1
2030			(1.2)	10.0	4.1	15.3
2031			0.1	10.6	5.1	15.6
2032			0.1	11.4	6.2	17.5
2033			0.1	12.2	7.4	19.4

Year	Capital Costs: Road Upgrade	Capital Costs: Interchange	Operation and Maintenance	Benefits: Road Upgrade	Benefits: Interchange	Net Benefits
2034			0.1	13.0	9.1	22.0
2035			(1.2)	14.0	11.0	26.2
2036			0.1	15.0	13.1	28.0
2037			0.1	16.1	15.4	31.4
2038			0.1	17.2	18.0	35.2
NPV at 12%	**31.7**	**8.6**	**(0.2)**	**50.7**	**15.3**	**12.5**

( ) = negative, NPV = net present value.
Source: Asian Development Bank estimates.

G. Financial Analysis

21. The financial analysis has been conducted in accordance with Asian Development Bank (ADB) guidelines.[14] Since the project is non-revenue generating, the financial analysis therefore focused on the financial capacity of the Ministry of Transport (MOT) to meet the maintenance cost of the new facilities. The overall financial position of the MOT was projected from 2018 to 2025.

22. The MOT will be the executing agency and Project Management Unit 1 of the MOT will be the implementing agency for the project road. Therefore, the funds for maintenance of the project road will come from the MOT's annual budget. The forecast income and expenditure of the MOT, projected based on its historical income and expenditure, shows that it will have sufficient funds to conduct annual routine maintenance on the project road when it takes responsibility for the maintenance starting in 2019. Additionally, the MOT is expected to have sufficient funds to undertake periodic maintenance ($1.86 million required in 2023) along with annual routine maintenance. The projected income and expenditure for MOT is shown in Table 4.

Table 4: Income and Expenditure of the Ministry of Transport
($ million)

Item	2018	2019	2020	2021	2022	2023	2024	2025
Income	**3,377.08**	**3,489.07**	**3,617.18**	**3,816.31**	**4,027.42**	**4,251.25**	**4,488.56**	**4,740.16**
Expenditures								
Routine maintenance	82.49	86.62	90.95	95.50	100.27	105.29	110.55	116.08
Periodic maintenance	120.26	126.27	132.58	139.21	146.17	153.48	161.16	169.22
Rehabilitation	80.17	84.18	88.39	92.81	97.45	102.32	107.44	112.81
Emergency maintenance	63.67	66.85	70.20	73.71	77.39	81.26	85.32	89.59
Bridge maintenance	14.56	15.29	16.05	16.85	17.70	18.58	19.51	20.48
Construction	2,898.37	3,043.29	3,195.45	3,355.23	3,522.99	3,699.14	3,884.09	4,078.30
Total Expenditure	**3,259.52**	**3,422.50**	**3,593.62**	**3,773.30**	**3,961.97**	**4,160.07**	**4,368.07**	**4,586.47**
Surplus	**117.55**	**66.58**	**23.56**	**43.00**	**65.46**	**91.19**	**120.49**	**153.68**
Maintenance for Highway 217 (Phase 2)		0.66	0.66	0.66	0.66	1.86	0.66	0.66
Surplus	**117.55**	**65.92**	**22.90**	**42.34**	**64.80**	**89.33**	**119.83**	**153.02**

Source: ADB estimates

[14] ADB. 2005. *Financial Management and Analysis of Projects*. Manila; ADB. 2009. *Financial Due Diligence: A Methodology Note*. Manila.

23. The project was evaluated to be financially sustainable. The projected financial positions of the project owners, based on historical income and expenditure statements, confirm their financial capacity to cover the recurrent costs to sustain the roads and its facilities upgraded under the project.

24. As part of an overall road sector reform process, the government established a Viet Nam National Road Maintenance Fund in 2012, financed from vehicle registration fees and budgetary allocations. During 2013–2014, the fund's revenue increased from D6.9 trillion to D8.0 trillion. In addition, Viet Nam has received assistance from World Bank, the Japan International Cooperation Agency, and the Government of Australia to develop a road asset management system to help optimize the efficiency of its maintenance program.

25. Given the government's support to the project by assuring that it will fund the operating expenditure and periodic maintenance, the existence of sound arrangements for funding and managing maintenance works, adequate budgetary allocation to Ministry of Finance covering recurrent costs of operating the project is reasonably expected.