# ECONOMIC AND FINANCIAL ANALYSIS

## A. Macroeconomic and Sector Context

1. During 2012–2014, Myanmar's economy underwent a transformation from a history of disappointingly low growth to what could be a phase of quick catch-up with neighboring countries. It is estimated that Myanmar's gross domestic product (GDP) per capita stagnated from 1900 to 1990, and then grew at 2.7% annually from 1990 to 2010, against an Asian average of 4.2%.[1] In 2012, Myanmar initiated a transformation towards a democratic and market-based economy. The government floated the kyat in April 2012, implemented tax and licensing reforms benefiting private businesses, and started removing restrictions to foreign investments and imports. There are now prospects for Myanmar's GDP to grow at 7% annually in the medium term and potentially up to 8% until 2030 (a range of 5.7% to 6.7% annual growth in GDP per capita).[2]

2. Macroeconomic changes have had broad impacts on the transport sector, where the depth and pace of change have been staggering. The development of Myanmar's transport sector was long hampered by economic distortions: (i) lack of access to foreign exchange, (ii) high license costs for vehicle imports, (iii) coexistence of a subsidized fuel market (for public operators) with a black market (for private ones), (iv) nonmarket freight allocation system for government-related transport needs, and (v) the presence of large loss-making, low productivity public transport operators. Transport was cheap but slow and unreliable for those shippers who could rely on public operators, but it was expensive for those who needed to use the small-scale private operators. From 1990 to 2010, the number of heavy trucks in Myanmar grew at 2.5% annually, well below the pace of growth of the economy. In 2010, there were only 4.5 cars per 1,000 people in Myanmar. With most of the distortions gradually removed, Myanmar's transport sector is booming. The share of public operators has been falling quickly, while private road transport operators and individual transport means (cars and motorcycles) have thrived. In 2013, the size of the truck fleet increased by 55% and the size of the car fleet increased by 26%.

## B. Project Rationale

3. The project road is located in the Ayeyarwaddy Delta, which is Myanmar's principal rice production region and has the potential for large-scale agribusiness and seafood industries. Although served by an extensive inland waterway network, the economic activities of the region depend heavily on its exiting core road network. This network has largely fallen into disrepair, with much of it beyond conventional maintenance treatments. As a consequence, most of the network requires complete reconstruction.

4. An important link in this network is the road from Maubin to Phyapon, which traverses the rich agricultural area on the southeastern side of the delta. The lack of an effective road system is a significant constraint to economic growth and development. Cash crops and high-value seafood are not yet viable industries as the travel times along the existing road network place the primary market of Yangon effectively out of reach. Improvements to the core road network would allow this highly productive region to realize its economic potential and greatly enhance its agricultural and seafood industries. Rehabilitation of the Maubin–Phyapon road would (i) improve connections within this densely populated, poor, but productive agricultural area; and (ii) provide access for communities in the project area to economic, health, education,

[1] McKinsey Global Institute. 2013. *Myanmar's Moment: Unique Opportunities, Major Challenges*.
[2] Asian Development Bank (ADB). 2012. *Myanmar in Transition: Opportunities and Challenges.* Manila.

and employment opportunities.

5. The current road is a narrow rural road of 5.5 meters (m) to 6.5 m in width, dropping to 4.5–5.0 m in urban areas. It has wide but steep earth shoulders. The road is paved with rough hand-laid macadam, as is common throughout Myanmar. The road alignment is good, but because it is located among rice paddy fields on a low embankment of 0.7–1.5 m, and because drainage is insufficient, the road base and subgrade are moist and prone to failure. The road surface in 2013 was generally poor, with sections ranging from fair, with an International Roughness Index (IRI) of 6 m per kilometer (km), to very poor (IRI of 15), with an average IRI of 8.4. About 25% of the pavement surface has failed. Because of the poor road condition, traffic speed is slow at about 25 km per hour (kph), so it takes about 2.5 hours for a car to go from Maubin to Phyapon. The road carries moderate traffic volumes (average daily traffic in 2013 of around 1,000 vehicles, of which 70% are motorcycles) and serves mainly local transport needs (86% of the traffic travels less than the entire road length).

6. A lasting and sustainable improvement of the surface of this road would facilitate the movement of people and goods between Maubin and Phyapon. It would also create a new quality north–south road corridor in the Ayeyarwaddy Delta, densifying the trunk road network in the area.

## C. Project Definition and Option Analysis

7. Several options were considered to meet the project's objective to improve the connection between Maubin and Phyapon. Improvements to the river transport infrastructure would only benefit a small portion of the local economy and yield limited benefits without further sector-wide improvements. An improvement of the road, however, would also benefit river transport by providing landing points at the numerous locations where waterways meet the road.

8. For the purpose of the analysis, the without-project case considers that the current maintenance strategy is extended indefinitely. In this case, Public Works would keep maintaining the current road through labor-intensive methods. This would involve routine maintenance as well as the frequent overlaying of the road surface with hand-laid macadam. The cost of this solution would be high, estimated at $400,000 annually ($7,400 per km), in line with the average budget spent by Public Works in the last 4 years on the road. This strategy would not meet the objectives of the government, as it would just prevent a complete degradation 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 poor to very poor (average IRI of 9 until 2018, then 10 thereafter) under this strategy.

9. The project considered is for the complete reconstruction of the road to a width of 6.6 m (two 3.3 m lanes), the adjunction of 1.8 m paved shoulders, and the elevation of the road pavement by an average 0.35 m. Because the base has failed over large sections, and because the materials of the original subgrade are insufficiently strong and dense, pavement rehabilitation or overlays would only provide short-term solutions. Only complete reconstruction can lead to better long-term pavement performance. Besides, the inclusion of wide paved shoulders will enable faster speeds and improved road safety, in a context where the vehicle fleet includes many slow moving vehicles. Complete reconstruction will also improve the durability of the road by keeping the base below the traffic lanes further from water. Pavement design life is 20 years.

10. Two pavement options were considered: double bitumen surface treatment and asphalt concrete (50 millimeters). The use of double bitumen surface treatment would have lowered

project costs by about $6 million, with slightly higher economic returns. Based on experience in other Southeast Asian countries, it was considered adequate for the level of traffic observed. However, Public Works has little experience with double bitumen surface treatment and may not be able to ensure maintenance. The chosen solution of asphalt concrete surface will provide a smoother surface (estimated IRI of 3, falling to 5 after 20 years) and be easier to maintain. The maintenance strategy considered in the with-project situation includes annual routine maintenance at $1,400 per km, and a 5 centimeter asphaltic overlay every 10 years.

## D. Traffic Forecasts

11. The traffic baseline was determined using a 24-hour classified traffic count and sample origin-destination surveys. This baseline was compared with the monthly records for 2012 from toll gates located on the project road near Maubin and Phyapon, and it was adjusted for seasonal variations. The estimated annual average daily traffic along the entire road reached around 1,000 vehicles per day. The road is mainly used for passengers (annual average of 1.4 million) rather than freight movements (annual average of 50,000 tons).

12. Traffic forecasts were based on the following assumptions: (i) projections of economic GDP growth over the construction and first 20 years of operation; projections for 2014–2018 use an average rate of growth of 7.0% annually,[3] falling gradually so that the average growth during 2013–2038 is 6.3%; (ii) an elasticity of transport demand of 1.5 until 2020, reflecting a catch-up phase, falling to 1.0 for freight and 1.2 for passenger demand in line with long-term international levels; (iii) a gradual shift in the transport fleet towards the increased use of private cars and larger, more efficient trucks, rather than small utility vehicles and motorcycles (the share of which is anticipated to fall from 70% to 55%); and (iv) traffic generated by the decrease in transport costs (demand to price elasticity of –0.2). Future passenger volumes and freight levels were converted into traffic forecasts using typical observed load factors by type of vehicle.

13. Traffic forecasts were prepared for three road sections: Maubin–Kyaiklat (32.2 km), Kyaiklat urban area (4.7 km), and Kyaiklat–Phyapon (17.8 km). After considering travel costs and time, it was evident that the project would not lead to diversion of traffic from other itineraries or modes of transport. Overall, traffic is expected to grow at a 7.4% annual rate from 2013 to 2038. Table 1 presents summary traffic forecasts.

**Table 1: Summary Traffic Forecasts: Annual Average Daily Traffic**

| Vehicle Type | 2013 | 2018 | 2028 | 2038 |
|---|---|---|---|---|
| Motorcycle | 775 | 1,281 | 2,745 | 4,642 |
| Small passenger vehicle | 139 | 254 | 688 | 1,634 |
| Large car | 31 | 71 | 313 | 1,210 |
| Small bus | 14 | 26 | 74 | 186 |
| Large bus | 54 | 83 | 162 | 279 |
| Small utility vehicle | 16 | 26 | 54 | 85 |
| Light truck | 31 | 44 | 68 | 86 |
| Medium truck | 24 | 38 | 74 | 117 |
| Large rigid truck | 2 | 4 | 16 | 57 |
| Articulated truck | 0 | 5 | 13 | 29 |
| **Total** | **1,086** | **1,832** | **4,207** | **8,325** |

Source: Asian Development Bank estimates.

[3] International Monetary Fund. 2013. *World Economic Outlook Database October 2013*. Washington, DC.

## E. Cost–Benefit Analysis

14. **Project costs.** The project capital economic costs total $61.8 million. These costs include civil works, supervision, management and incremental administration, environmental mitigation, land opportunity cost (based on the value of lost rice production), 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 0.979 to local costs. The analysis uses the world price numeraire. Labor was not shadow priced as (i) the civil works have only a small wage component, and (ii) there is uncertainty regarding the extent of underemployment and the level of shadow wages. A residual value of 45% of the initial project cost, representing the value of the sub-base and the bridges was considered at the end of the evaluation period.

15. **Reduction in vehicle operating costs**. The improvement of the pavement will lead to an immediate reduction of vehicle operating costs by 35%. Vehicle operating costs were determined with the equations of the Highway Design and Management (HDM-4) software on the basis of parameters described in Table 2. The net present value (NPV) of this benefit over 20 years at a 12% discount rate is $22.4 million.

**Table 2: Main Vehicle Fleet Parameters and Operating Costs**

| Road Vehicle Fleet | Motor-cycle | Small passenger vehicle | Large Car | Small Bus | Large Bus | Medium Truck | Heavy Truck |
|---|---|---|---|---|---|---|---|
| **Economic Unit Costs** ($) | | | | | | | |
| New vehicle cost per vehicle | 1,600 | 12,000 | 34,000 | 43,000 | 98,000 | 49,000 | 80,000 |
| Fuel cost per liter | 0.79 | 0.79 | 0.79 | 0.91 | 0.91 | 0.91 | 0.91 |
| Maintenance labor cost per hour | 0.59 | 0.81 | 1.36 | 0.98 | 1.42 | 0.93 | 1.01 |
| Crew cost per hour | 0.12 | 0.19 | 0.48 | 1.13 | 1.78 | 1.45 | 1.62 |
| **Utilization** | | | | | | | |
| Distance driven per year (km) | 13,000 | 25,000 | 33,000 | 45,000 | 82,000 | 57,000 | 74,000 |
| Time driven per year (hours) | 730 | 800 | 1,300 | 1,400 | 2,000 | 1,800 | 2,200 |
| Service life (years) | 9 | 10 | 10 | 9 | 10 | 10 | 11 |
| **Vehicle Operating Costs** | | | | | | | |
| $ per 100 km at IRI 3, 60 kph speed | 4.4 | 14.9 | 24.9 | 34.0 | 56.4 | 42.1 | 71.7 |
| $ per 100 km at IRI 10, 25 kph speed | 6.1 | 23.0 | 42.6 | 53.9 | 95.8 | 65.5 | 113.2 |

IRI = International Roughness Index, km = kilometer, kph = kilometer per hour.
Source: Asian Development Bank estimates.

16. **Reduction in travel time costs**. The improvement of the road width and pavement will reduce travel times, bringing average speeds from 25 kph to 60 kph. The value of passengers' time was estimated to be $1.00 per hour for cars, and $0.40 per hour for other vehicles, based on standard levels in other Asian countries at a similar level of economic development as Myanmar. The value of non-work time was estimated to be 25% of the average hourly income per capita in the area. Unit values were taken to rise in line with GDP per capita. The NPV of this benefit is $17.3 million.

17. **Reduction in road crashes**. The wider road pavement will lead to a better segregation of low and high speed traffic, leading to an expected reduction in road accidents. The accident rate on the project road is currently 30% higher than Myanmar's national average of 4.3 deaths and 30 serious injuries per 100 million vehicles per km, which is very high by international

standards. It was assumed that the accident rate on the project road will decline to the national average. The reduction in fatalities was valued at 70 times the average GDP per capita, and the reduction in serious injuries was valued at 17 times.[4] The NPV of this benefit is $2.9 million.

18. **Generated traffic benefits**. The project will lead to an increase in traffic compared to the without-project case of 3% to 10%. The benefits for this new traffic demand is on average half the benefit of that for the existing demand. The NPV of this benefit is $2.7 million.

19. **Cost–benefit analysis.** The economic interest rate of return (EIRR) of the project's costs and benefits is 12.9%, with an NPV of $3.73 million at a 12% discount rate (Table 3).

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

| Year | Capital Costs | O&M | VOCs | Time | Road crashes | Generated Traffic | Net Benefits |
|---|---|---|---|---|---|---|---|
| 2014 | 0.57 | (0.36) | | | | | (0.21) |
| 2015 | 13.92 | (0.36) | | | | | (13.56) |
| 2016 | 18.54 | (0.36) | | | | | (18.18) |
| 2017 | 23.26 | (0.36) | | | | | (22.90) |
| 2018 | 5.64 | (0.36) | 2.36 | 2.03 | 0.23 | 0.23 | (0.43) |
| 2019 | | (0.32) | 2.59 | 2.20 | 0.26 | 0.25 | 5.61 |
| 2020 | | (0.32) | 2.85 | 2.38 | 0.29 | 0.27 | 6.11 |
| 2021 | | (0.32) | 3.13 | 2.58 | 0.33 | 0.29 | 6.65 |
| 2022 | | (0.32) | 3.44 | 2.79 | 0.37 | 0.32 | 7.24 |
| 2023 | | (0.32) | 3.77 | 3.02 | 0.42 | 0.35 | 7.89 |
| 2024 | | (0.32) | 4.15 | 3.27 | 0.48 | 0.38 | 8.59 |
| 2025 | | (0.32) | 4.55 | 3.54 | 0.54 | 0.42 | 9.37 |
| 2026 | | (0.32) | 5.00 | 3.84 | 0.61 | 0.45 | 10.22 |
| 2027 | | (0.32) | 5.49 | 4.15 | 0.69 | 0.50 | 11.15 |
| 2028 | | 8.80 | 6.03 | 4.50 | 0.78 | 0.50 | 3.01 |
| 2029 | | (0.32) | 6.51 | 4.82 | 0.87 | 0.51 | 13.02 |
| 2030 | | (0.32) | 7.02 | 5.17 | 0.98 | 0.50 | 13.99 |
| 2031 | | (0.32) | 7.57 | 5.54 | 1.09 | 0.50 | 15.02 |
| 2032 | | (0.32) | 8.17 | 5.94 | 1.23 | 0.49 | 16.14 |
| 2033 | | (0.32) | 8.81 | 6.37 | 1.37 | 0.48 | 17.35 |
| 2034 | | (0.32) | 9.50 | 6.82 | 1.54 | 0.47 | 18.65 |
| 2035 | | (0.32) | 10.24 | 7.32 | 1.72 | 0.45 | 20.05 |
| 2036 | | (0.32) | 11.05 | 7.84 | 1.93 | 0.42 | 21.56 |
| 2037 | | (0.32) | 11.92 | 8.41 | 2.16 | 0.39 | 23.19 |
| 2038 | | 8.80 | 12.85 | 9.01 | 2.42 | 0.35 | 15.84 |
| 2039 | (25.33) | (7.89) | 0.00 | 0.00 | 0.00 | 0.00 | 33.21 |
| **NPV at 12%** | **41.45** | **(0.86)** | **22.40** | **17.27** | **2.92** | **2.71** | **3.73** |

( ) = negative, NPV = net present value, O&M = operation and maintenance, VOC = vehicle operating cost.
Note: Capital costs and O&M are net values.
Source: Asian Development Bank estimates.

## F. Risk, Sustainability, and Sensitivity

20. The project's rate of return can withstand limited negative impacts, such as an increase in capital costs of 10% (EIRR of 11.9%), the omission of road safety and generated traffic benefits (EIRR of 11.8%), a reduction of benefits by 10% (EIRR of 11.8%), or a 1-year delay in project

[4] Values recommended by: International Road Assessment Program. 2008. *The True Cost of Road Crashes*. Basingstoke, United Kingdom.

implementation (EIRR of 11.8%). Due to the 20-year design horizon, the project's viability would also be only moderately affected in case maintenance is deficient (EIRR of 11.9%). This is unlikely given the good track record of Public Works at financing maintenance on the project road, and given the limited maintenance needs required by the chosen surfacing solution.

21. The project's viability would be compromised if traffic failed to materialize (e.g., if macroeconomic reforms are reverted). In a scenario where the economy reverts to its previous long-term trends after 2016 (4.7% growth rate, low elasticity of transport to economic growth), long-term traffic potential would be half of that assumed in this evaluation (i.e., the annual average daily traffic would be 4,200 in 2038). The project's economic returns would fall substantially but remain relatively high (EIRR of 8.7%).

## G. Financial Analysis

22. The approach to the financial analysis follows the guidelines for the financial analysis of projects described in the Financial Management and Analysis of Projects (2005) of the Asian Development Bank (ADB). Given that the executing agency and project owner is a general government sector unit and that the project is non-revenue generating, the analysis assesses the project executing agency's financial capacity to meet the recurrent costs of operating and maintaining the developed facilities in a sustainable manner. Overall, the annualized maintenance costs of the road are expected to increase moderately from $0.4 million to $0.6 million. These costs represent only 0.1% of Public Works' annual spending. The choice of a more durable road surface will limit Public Works' maintenance requirements for the first 10 years of the project to about $80,000 per km annually. The road will then likely require periodic maintenance, a type of road network expenditure that Public Works seems to inadequately finance (although historically not for the project road). Various ADB activities will help limit the risk that this periodic maintenance is not carried out in due time, e.g., it is implementing a technical assistance project to improve overall road maintenance management and financing.[5] Also, the capacity building component of the project seeks to establish an efficient maintenance regime on Public Works' road network.

## H. Financial Position

23. The Ministry of Construction is the executing agency and will be responsible for operation and maintenance after the project's completion. The financial analysis, therefore, focuses on the future financial position of the Ministry of Construction, aiming to appraise its financial capacity for covering the recurrent expenditures of the project. The future financial position of the Ministry of Construction is appraised based on its current financial position and budgetary allocation.

## I. Results of Financial Analysis

24. The future financial position of the executing agency confirms its financial capacity to cover the recurrent costs to sustain facilities developed under the project. Moreover, given the government's support to the project by assuring that it will fund the operating expenditure and periodic maintenance, adequate budgetary allocation to the Ministry of Construction for covering recurrent costs of operating the project is reasonably expected.

[5] ADB. 2013. *Technical Assistance to the Republic of the Union of Myanmar: Developing the Asset Management Program for Myanmar Roads*. Manila (TA 8327-MYA approved on 20 February 2013 for $1,365,000).