

ECONOMIC AND FINANCIAL ANALYSIS

A. Economic Analysis

1. Introduction

1. The proposed South Asia Subregional Economic Cooperation (SASEC) Subregional Road Project in Bangladesh includes two main components: (i) capacity augmentation of the 70 kilometer (km) section of the Dhaka–Northwest corridor (N4) by four-laning of the Joydevpur–Chandra–Tangail–Elegna section; and (ii) improvement of Benapole and Burimari land ports. Capacity augmentation of the N4 will facilitate economic development of the northwest region of the country and subregional trade with Bhutan, India, and Nepal as the N4 provides the main trade route to Nepal and Bhutan. The N4 and N405 section under consideration, with a two-lane carriageway, currently carries 16,000–20,000 vehicles per day—resulting in a poor level of service. It is the main national highway connecting the northwestern parts of Bangladesh to Dhaka and Chittagong and is in need of capacity augmentation. The proposed divided carriageway will also improve road safety. The improvements to the land ports aim to improve the transaction efficiency, facilitate increased import and export trade with neighboring countries, and reduce damage to goods in transit. The proposed project is important for enhancing the road network efficiency, economic development of the northwest region of the country, and subregional transport and trade.

2. Economic and financial analysis has been conducted, based on the traffic estimates and other basic input from the technical assistance (TA) consultant's reports.¹

2. Demand Analysis and Forecast

3. **Joydevpur–Elegna road.** The base year traffic volumes were obtained from the classified traffic counts carried out on project road sections in January 2011 and the Jamuna bridge traffic records. The Jamuna bridge traffic records over the past 5 years were analyzed to derive seasonal correction factors. The seasonal variation for January worked out so no correction was required. The project road is an established route used by all north–south traffic in the project influence area and the proposed upgrading is not expected to result in any traffic diversion. The traffic pattern indicates three distinct traffic sections. The base year traffic data are given in Table 1. The traffic composition indicates a high percentage of truck traffic—39%–43% of total traffic. The share of buses is 22%–32% while cars and utility vehicles comprise 14%–26%. The proportion of two- and three-wheeler traffic is low (7%–13%) along the corridor, except within the influence areas of the towns along the corridor.

Table 1: Traffic on Joydevpur–Jamuna Bridge Approach, 2011

Section	Length (km)	Trucks	Buses	Utility	Cars	Two- and Three-Wheelers	AADT
Joydevpur–Chandra	17	7,488	4,128	3,065	2,046	2,389	19,116
Chandra –Tangali bypass	41	6,576	5,119	1,509	1,717	1,193	16,114
Tangali bypass–Elegna	12	6,898	4,837	1,122	1,220	2,112	16,189

AADT = annual average daily traffic, km = kilometer.

Source: Consultant's reports.

¹ ADB. 2012. Priority Roads Project. Consultant's report. Manila. (TA 7383-BAN), February 2012; and ADB. 2012. Benapole and Burimari Land Border Port Improvement Study – Bangladesh. Consultant's report. Manila. (TA 7650-REG).

4. Historical traffic data for Jamuna bridge toll plaza give a good indication of traffic growth on the project road. The analysis indicates that goods traffic grew at an average rate of 10.9% from FY2005 to FY2010, and passenger traffic grew by 10.5% per year over the same period. The gross domestic product of Bangladesh grew at an average of 6.1% over this period, indicating an implied elasticity of 1.7–1.8. Growth was higher for light trucks than large trucks and the growth in tonnage works out at about 9% per annum, implying an elasticity of 1.5, which is in the range of elasticity observed in other countries in the region. The growth in the vehicle fleet is another indicator of traffic growth. The growth in vehicle fleet observed during 2003–2010 is 4.5% for goods vehicles and 5% for passenger vehicles. The high growth rate observed on Jamuna bridge (compared to the vehicle fleet growth) can be attributed to the large area it serves and the significantly higher increase in subregional trade. Based on these considerations and considering the traffic growth used in recent similar studies, the medium-term growth rate is slightly lower than the recent past growth rate observed—an annual growth rate of 8% is adopted for goods vehicles and 7% for passenger vehicles over 2011–2020. Beyond 2020, growth rates are capped at 6% per annum.

5. **Improvement of Benapole and Burimari land ports.** Benapole is the largest land customs station in Bangladesh. It is located on the Dhaka–Kolkatta corridor and facilitates the majority of import–export trade with India. In FY2011, imports through Benapole amounted to 1.14 million tons and exports constituted 0.3 million tons. During the last 6 years, annual growth in imports averaged 3.3% while exports averaged 7.8%. A total of 103,683 trucks entered the land port with import goods while 24,345 trucks entered with export goods in FY2011. Burimari is situated on Bangladesh’s northern border with West Bengal, India, and provides a strategic road transit route for freight going to and coming from Phuentsholing Bhutan through West Bengal, India. Burimari handles part of the Bangladesh–India bilateral trade as well as the whole volume of Bangladesh–Bhutan bilateral trade. The total amount of goods handled by Burimari land port was 286,692 tons of import and 139,137 tons of export in FY2011, of which trade with India constituted 55% and trade with Bhutan 45%. In FY2011, 37,684 trucks entered Burimari land port. The import–export data in the past 3 years show a high 29.2% annual growth rate in trade with India and 2.3% annual growth in trade with Bhutan. Total imports grew at 7.6% per annum and exports grew at 35.2%. This high growth rate may be because this land port has only been operational since FY2009.

6. The import–export traffic at the land ports is expected to grow at a pace close to or higher than the import–export growth rates observed at Benapole, with many trade facilitation measures under implementation, such as the removal of quantity restrictions on garments and reducing the list of negative goods. The subregional trade corridors are also proposed for upgrading. The development and streamlining of land ports will reduce the time and cost of imports and exports and will help enhance import–export growth. The growth scenarios are summarized in Table 2. Without the project, growth would be hampered and a lower growth scenario is assumed. With the proposed land port improvements, the import–export traffic is assumed to grow at an annual rate close to the recent observed growth rates; this is the medium growth scenario. In the high growth scenario, the rest of the master plan recommendations are realized while improvements to port facilities and alleviation of nonphysical barriers will boost bilateral trade higher than that observed in the past.

Table 2: Projected Import/Export Growth Rates at the Land Ports

Period	Projected Growth Rates for Imports (%)			Projected Growth Rates for Exports (%)		
	Low	Medium	High	Low	Medium	High
2012–2020	2.0	4.0	6.0	4.0	8.0	10.0
2021–2030	0.5	3.0	4.0	2.0	6.0	7.0

Source: Consultant’s reports.

3. Project Design

7. **Joydevpur–Elegna road.** Traffic demand on the project road section exceeds the capacity of the existing two-lane carriageway. The proposal is to widen it to a four-lane divided carriageway with a segregated slow-moving vehicle traffic (SMVT) lane. This would significantly reduce potential for traffic accidents, especially fatal accidents. The project design also includes three flyovers at the congested urban sections along the corridor, reducing congestion and delays for through traffic; and three overpasses at major intersections, which will improve traffic safety. Other project design elements include bus bays; demarcated pedestrian crossings, including pedestrian overpasses; improvement of intersections with minor roads via channelization; reduction of the impact of roadside activities and general encroachment; and treatment of identified accident black spots along the corridor.

8. **Improvement of Benapole and Burimari land ports.** The Benapole land port master plan prepared in 2005 identified six development phases from immediate to medium and long term. Bangladesh Land Port Authority (BLPA) is implementing Phase 1 with domestic financing. Ongoing Asian Development Bank (ADB) TA(footnote 1) has carried out the Benapole and Burimari land port improvement study and has identified high priority projects to be implemented under the proposed ADB project. The projects identified aim to (i) reduce dwell time for trucks and cargo, (ii) reduce damage to cargo during handling at transshipment bays during the wet season, (iii) decongest old sheds to allow more effective usage of storage capacity and introduce mechanization to modernize warehouse operations, (iv) improve drainage of the land port site, and (v) implement social and environmental safeguards in the development and operation of land ports.

9. The project components identified for Benapole land port for implementation under the proposed ADB project include (i) concrete paving of goods handling areas and drainage improvements, (ii) TA to simplify procedures and improve handling and warehousing to increase overall operational efficiency, (iii) construction of transshipment sheds to reduce damage to cargo during the wet season, (iv) improvement of existing storage sheds, and (v) development of a pilot warehouse with mechanized material handling.

10. Burimari land port expanded onto its new site in 2010. BLPA is implementing construction of an administrative building and additional storage warehouses. The land port operation along with other border services, including banking and quarantine, will transfer to the new administration building upon completion later in 2012. The project components identified for Burimari land port for implementation under the proposed ADB project include (i) drainage improvements, (ii) TA to simplify procedures and improve handling and warehousing to increase overall operational efficiency, and (iii) construction of transshipment sheds to reduce damage to cargo during the wet season.

4. Economic Analysis

a. Project Costs

11. The cost of civil works included in the project has been estimated based on bill of quantities and unit costs. The project financial cost is estimated at \$323.6 million for the road component including Roads and Highways Department improvement, and \$21.1 million for the Benapole and Buriari land ports. This project cost includes the cost of land acquisition and resettlement, environmental impact mitigation, utility shifting, construction supervision, project management, and physical contingencies (15%) but excludes any price contingency and

interest during construction. The cost estimates are based on 2011 unit rates and updated to 2012 rates. A conversion factor of 0.85 was adopted in estimating the economic cost from the financial cost based on the ADB TA study (footnote 1).

b. Project Benefits

12. **Joydevpur–Elegna road.** The proposed project will improve and maintain the level of service to desirable levels for the design period, eliminate traffic congestion, and result in significant time savings and operating cost savings for the road users. The proposed project design will reduce the traffic accident potential, with a divided carriageway, and greatly improve the traffic safety level for slow-moving and pedestrian traffic with segregated SMVT lanes and flyovers in congested urban areas. The Highway Development and Management Model (HDM) 4 was used to estimate the project benefits with input data on traffic, road geometry, condition, and pavement structure with and without the project as well as maintenance and road improvement costs and vehicle operating cost parameters for representative vehicles. Reduced accident rates, and associated accident cost savings are included in the analysis.

13. **Improvement of Benapole and Burimari land ports.** The proposed project will (i) improve traffic management and vehicle flow, and the total time spent by trucks for passage through the land ports is projected to fall from the current 6.5 days in 2012 to 5.0 days in the medium term; (ii) enable transshipment operations during heavy rain days, with the construction of transshipment sheds, which will avoid additional truck and crew idling costs; and (iii) reduce loss of perishable goods. For the analysis, it is estimated that transshipment operation is possible for an additional 70 working days per year with the construction of transshipment sheds. The avoided loss of perishable goods is conservatively assumed at 5% of the value of goods imported during the rainy days, with the construction of transshipment sheds.

c. Results of Economic Analysis

14. A 4-year implementation period is considered for the detailed design and construction of the proposed subprojects. The analysis considers a 20-year operational period starting in 2016. A discount rate of 12% is used as an acceptable economic rate of return. The economic life of the project components range from 20 to 40 years² and the residual value at the end of the project period is considered by applying straight-line depreciation. Economic evaluation was carried out for each of the project components by comparing the societal cost of transportation with and without the project options. The results for the economic internal rate of return (EIRR) and net present value (NPV) for the proposed project options are summarized in Table 3. The annual cost–benefit streams are presented in Tables 5 and 6. The results indicate that the proposed projects are viable, yielding an EIRR well above 12%, which indicates the high economic rate of return of the proposed projects.

Table 3: Economic Analysis Results

Project Component	EIRR (%)	NPV (Tk million)
Joydevpur–Elegna Road	27.2	49,389.6
Improvement of Benapole and Burimari land ports	32.8	2,962.2

EIRR = economic internal rate of return, NPV = net present value.

Source: Asian Development Bank.

² The economic life is 40 years for earthworks and the base for road widening, 40 years for bridges and overpasses, 20 years for pavements, and 20 years for civil works at land ports.

d. Sensitivity Analysis

14. Sensitivity analysis was carried out over the base case with respect to adverse changes in the costs and benefits. The following cases were analyzed: (i) base case, (ii) 15% increase in cost, (iii) 15% decrease in total benefits, and (iv) 15% increase in cost and 15% decrease in benefits. The results are presented in Table 4. The analysis shows that both projects have an EIRR above 12% in all sensitivity cases and are recommended for implementation.

Table 4: Results of Sensitivity Analysis

Project Component	EIRR (%)			
	Case I	Case II	Case III	Case IV
Joydevpur–Elegna Road	27.2	25.5 (490)	25.2 (79)	23.6 (66)
Improvement of Benapole and Burimari land ports	32.8	30.0 (397)	29.6 (75)	27.0 (60)

Note: Values in parentheses are switching values for variables (switching value indicates percentage change in a variable required for the EIRR to go below 12%).

EIRR = economic internal rate of return.

Source: Asian Development Bank.

Table 5: Joydebpur–Elegna Road – Comparison of Cost–Benefit Streams
(Tk million)

Year	Increase in Road Agency Costs			Road User Costs		Net Benefits
	Capital	Routine and Periodic	MT VOC Savings	MT Time Savings	Road Accident Savings	
2013	5,391.4	0.0	0.0	0.0	0.0	(5,384.9)
2014	7,200.1	0.0	0.0	0.0	0.0	(7,193.6)
2015	4,805.7	0.0	0.0	0.0	0.0	(4,799.3)
2016	0.0	3.2	696.6	1,393.2	599.4	2,694.1
2017	0.0	3.2	874.8	1,644.3	615.6	3,133.1
2018	0.0	3.2	1,101.6	1,887.3	664.2	3,649.1
2019	0.0	3.2	1,368.9	2,178.9	712.8	4,261.4
2020	0.0	3.2	1,660.5	2,462.4	769.5	4,891.6
2021	0.0	(466.6)	2,025.0	2,794.5	818.1	6,094.4
2022	0.0	1,094.3	1,571.4	2,640.6	858.6	3,980.3
2023	0.0	3.2	1,782.0	3,240.0	915.3	5,936.5
2024	0.0	3.2	2,130.3	3,661.2	972.0	6,758.6
2025	0.0	3.2	2,616.3	4,203.9	1,028.7	7,837.6
2026	0.0	3.2	3,531.6	5,159.7	1,085.4	9,777.5
2027	0.0	3.2	4,941.0	6,771.6	1,158.3	12,862.8
2028	0.0	(466.6)	8,132.4	10,311.3	1,223.1	20,137.4
2029	0.0	1,094.3	9,736.2	13,154.4	1,296.0	23,090.7
2030	0.0	3.2	16,467.3	21,724.2	1,377.0	39,564.5
2031	0.0	3.2	19,788.3	26,211.6	1,458.0	47,456.3
2032	0.0	3.2	28,431.0	37,656.9	1,547.1	67,632.6
2033	0.0	3.2	33,072.3	42,298.2	1,636.2	77,001.8
2034	0.0	(466.6)	39,195.9	48,097.8	1,733.4	89,495.3
2035	(5,567.1)	1,094.3	47,887.2	54,901.8	1,798.2	110,155.1
					EIRR (%)	27.2%
					NPV @12%	49,389.6

() = negative, EIRR = economic internal rate of return, MT = motorized traffic, NPV = net present value, VOC = vehicle operating cost.

Source: Asian Development Bank.

Table 6: Benapole and Burimari Land Ports – Comparison of Cost–Benefit Streams
(Tk million)

Year	Investment and Maintenance Cost	Reduced Dwell Time	Benefits Derived From		Net Benefits
			Avoided Idle Cost with Transshipment Sheds	Avoided Loss of Perishable Goods	
2013	254.3	0.0	0.0	0.0	(254.3)
2014	507.9	0.0	0.0	0.0	(507.9)
2015	507.9	0.0	0.0	0.0	(507.9)
2016	6.2	43.7	102.9	198.5	338.9
2017	7.9	91.5	105.3	204.9	393.8
2018	9.6	142.6	108.5	211.4	452.9
2019	11.5	196.8	111.8	217.9	515.0
2020	13.4	254.3	115.0	223.6	579.5
2021	14.8	321.6	116.6	226.8	650.2
2022	16.2	406.6	117.5	229.2	737.1
2023	17.6	514.4	119.1	230.9	846.7
2024	19.1	649.6	119.9	233.3	983.7
2025	20.6	821.3	120.7	235.7	1,157.2
2026	22.1	833.5	122.3	237.3	1,171.0
2027	23.7	846.5	123.9	240.6	1,187.3
2028	25.3	858.6	124.7	243.0	1,201.0
2029	27.1	871.6	126.4	244.6	1,215.5
2030	28.8	885.3	127.2	247.9	1,231.6
2031	30.6	898.3	128.8	250.3	1,246.8
2032	32.4	912.1	130.4	252.7	1,262.8
2033	34.3	926.6	131.2	255.2	1,278.7
2034	36.2	940.4	132.8	257.6	1,294.6
2035	38.2	955.8	133.7	260.8	1,312.1
				EIRR (%)	32.8
				NPV @12%	2,962.2

() = negative, EIRR = economic internal rate of return, NPV = net present value.

Source: Asian Development Bank.

B. Financial Analysis

15. The project has two main components: (i) capacity augmentation of the Joydevpur–Elegna section of the N4, and (ii) improvement of Benapole and Burimari land ports. In the road project, user fees or tolls are not envisaged at present in the absence of alternate routes, so no financial analysis have been carried out. BLPA charges user fees for traffic using the port facilities. A financial analysis was carried out on an incremental basis using the discounted cash flow method, calculating the internal rate of return of the proposed improvements to the Benapole and Burimari ports to assess if the investment will generate sufficient revenues from user fees to cover the capital, maintenance, and operation costs of the project.

16. Based on the estimated financial costs, the total amount needed to finance the improvements to land ports is \$21.1 million, including physical and price contingencies. This component will be funded from the Asian Development Fund (ADF) loan (\$19.22 million) and government of West Bengal resources (\$1.84 million). The proposed ADB funding of \$250 million for all project components comprises \$200 million from the ADF, \$30 million from the OPEC Fund for International Development (OFID), and \$20 million from the Abu Dhabi Fund for Development (ADFD).

17. The project financing terms are as follows: (i) the ADF portion will have a 32-year term, including a grace period of 8 years and an interest rate of 1.0% per annum during the grace

period and 1.5% per annum thereafter; (ii) the OFID portion will have a 20-year term, a grace period of 5 years, an interest rate of 1.25% per annum, and a service charge of 1.0%; and (iii) the ADFD portion will have a 20-year term, a grace period of 5 years, and an interest rate of 2.0% per annum.

18. The proposed project will streamline processing and improve traffic flow. It will benefit import–export traffic, with reduced vehicle and goods idle time; and it will reduce the loss of perishable goods and allow transshipment during rainy days, with the construction of transshipment sheds. The project investment is essential to improve the level of service and ensure that traffic growth is not hampered by increased congestion and delays at the land ports. The fees charged at the land ports include entrance fees, weighing charges, handling charges, storage charges, and equipment charges. The financial analysis has been carried out with projected traffic and current tariff rates.

19. A financial cost–benefit analysis was undertaken of the land port operation, considering the medium growth scenario with the project and the low growth scenario without the project. The analysis period adopted is 20 years after project completion in the case of land port improvement. All costs and revenues are expressed in real prices.

20. The project will be funded from an ADB loan and funds from government budgetary resources. The financial opportunity cost of capital to assess the financial viability of the project is derived by calculating the weighted average cost of capital (WACC). The WACC represents the cost incurred by the government in raising the capital required to implement the project. Calculation of the WACC for the project, based on ADB guidelines, is in Table 7. The cost of government funds is taken as the yield on the 20-year Government of Bangladesh Treasury bond, which was 12.1% in May 2012.³

Table 7: Calculation of Weighted Average Cost of Capital

Item	For the Government of Bangladesh				Total	
	ADB	ADF	ADB OFID	ADB ADFD Government		
Amount	198.0		30.0	30.0	86.7	344.7
Weighting	57.4		8.70	8.70	25.1	100.0
Nominal cost	1.4		1.3	2.0	12.1	
Tax rate	0.0		0.0	0.0	0.0	
Tax-adjusted nominal rate	1.4		1.3	2.0	12.1	
Inflation rate	1.0		1.0	1.0	6.0	
Real cost	0.4		0.3	1.0	6.1	
WACC (%)	1.9					

ADB = Asian Development Bank, ADF = Asian Development Fund, ADFD = Abu Dhabi Fund for Development, OFID = OPEC Fund for International Development, WACC = weighted average cost of capital.

Source: Asian Development Bank.

21. The financial analysis in real terms indicates a financial internal rate of return (FIRR) of 5.1% for the land port development. Comparing the FIRR with the estimated WACC of 1.9% indicates that the proposed project is financially viable. The financial NPV at the WACC is Tk766.9 million for the land port development. The cost and revenue stream for the projects are given in Table 9. Discounting the cash flows at WACC, the incremental revenues exceed the investment cost.

³ Bangladesh Bank, June 2012.

22. Sensitivity analysis was carried out to examine the sensitivity of the FIRR with adverse changes in key parameters that determine the project's costs and revenues. The parameters considered are (i) a 10% increase in capital costs, (ii) a 10% reduction in revenue, (iii) a combination of 10% capital cost increase and 10% benefit reduction, and (iv) a high growth scenario. The results of the sensitivity analysis are in Table 8. The sensitivity analysis indicates that, even with adverse variations in costs and benefits, the project remains financially viable with an FIRR higher than the WACC.

Table 8: Sensitivity Analysis – Land Port Development

Item	FIRR (%)	FNPV (Tk million)
Base case	5.1	772.5
(i) Project costs increased by 10%	4.4	628.0
(ii) Revenue and Benefit reduced by 10%	4.1	512.6
(iii) combination of (i) and (ii)	3.4	368.1
(iv) High growth scenario	9.6	2,373.3

FIRR = financial internal rate of return, FNPV = financial net present value.

Source: Asian Development Bank.

Table 9: Financial Analysis Summary - Land Port Development (Tk million)

Year	Incremental Costs	Net Incremental Revenue for Benapole Land Port	Net Incremental Revenue for Burimari Land Port	Net Cash Flow
2013	301.3	0.0	0.0	(301.3)
2014	602.6	0.0	0.0	(602.6)
2015	602.6	0.0	0.0	(602.6)
2016	7.3	28.1	5.0	25.8
2017	9.3	36.5	6.6	33.9
2018	11.3	45.7	8.3	42.6
2019	13.5	55.5	10.1	52.1
2020	15.8	66.1	12.1	62.4
2021	17.4	77.8	14.3	74.6
2022	19.0	90.0	16.4	87.5
2023	20.7	102.9	18.8	101.0
2024	22.4	116.4	21.3	115.3
2025	24.2	130.5	24.0	130.2
2026	26.0	145.3	26.7	146.0
2027	27.9	160.9	29.7	162.7
2028	29.8	177.2	32.8	180.2
2029	31.8	194.4	36.0	198.6
2030	33.9	212.4	39.5	218.1
2031	36.0	231.3	43.2	238.5
2032	38.1	251.0	47.1	260.0
2033	40.3	271.8	51.1	282.6
2034	42.6	293.6	55.4	306.4
2035	45.0	316.5	59.9	331.5
			FIRR (%)	5.1
			NPV at WACC	772.5

() = negative, FIRR = financial internal rate of return, NPV = net present value, WACC = weighted average cost of capital.

Source: Asian Development Bank.