

## ECONOMIC AND FINANCIAL ANALYSIS

### A. Introduction

1. The outputs will be (i) the construction of roads and the establishment of trade infrastructure; (ii) the improvement of road construction and maintenance capacity; and (iii) the promotion of eco-friendly transport. The first output will involve (i) construction of 68.3 km of the SEWH between Nganglam and Dewathang and about 1.2 km of access road between a point on Bhutan's border with India and the Pasakha industrial estate, (b) establishment of a mini dry port in Phuentsholing City and a land custom station at Alay, which is the end of the new access road between a point on Bhutan's border with India and the Pasakha industrial estate and (c) construction of 2.7 km of road between the new mini dry port and a national highway to bypass traffic congestion in Phuentsholing City.

2. The economic analysis was conducted by grouping the subprojects into three components, based on the linkages between them: (i) the construction of the Nganglam–Dewathang section of the SEWH, (ii) the building of the Pasakha access road and the Alay land customs station to provide direct access for freight traffic between India and the Pasakha industrial estate, and (iii) the establishment of the Phuentsholing mini dry port and a bypass road from then new mini dry port to a national highway to streamline customs clearance for imports and exports and relieve freight traffic congestion within the Phuentsholing city center.

### B. Key Assumptions

3. The economic analysis has used the world price numeraire presented in domestic currency and project costs as of January 2014. A standard conversion factor of 0.98 was applied to convert all non-tradable goods, which was calculated as a proportion of total import and export values to total import and export values and trade-related duties. This relatively high standard conversion factor is due to the low import duties and Bhutan's free trade agreement with India. A shadow wage rate of 1.0 was applied, based on the fact that unskilled labor is in short supply in Bhutan and most unskilled workers at construction sites are temporary migrant workers from India.<sup>1</sup> An analysis period of 20 years of operation after completion of construction was used, and the residual value for each road section at the end of analysis period was calculated for road components using straight-line depreciation.<sup>2</sup> A discount rate of 12% was used to calculate the net present value.

#### Demand Analysis and Forecast

##### (i) Nganglam–Dewathang Section of South East–West Highway Component

4. The construction of the new section of the SEWH will provide a direct connection between economic centers in southeastern part of Bhutan. The future traffic of the road was categorized into two types: (i) local traffic growth, consisting of local traffic using the existing tracks and new traffic generated by the new road construction; and (ii) traffic diverted to the new SEWH section due to the fact that it will be 103 km shorter than the alternative route via Pemagatshel that is currently the shortest option. The base-year traffic volume for locally

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<sup>1</sup> A 2012 labor force survey by the Ministry of Labor and Human Resources indicated that the unemployment rate in Bhutan was 2.1%, which is lower than the country's natural unemployment rate of 2.5%. The 2013 country diagnostic study for Bhutan indicates that many manual labor positions are held by foreign workers, which shows that a shortage of domestic unskilled construction workers exists. (ADB. 2013. *Bhutan Critical Development Constraints*. Manila.)

<sup>2</sup> The analysis assumed that the earthwork, pavement base layers for widening and structures last over 30 years and bituminous pavement lasts for 20 years based on the technical standards with appropriate maintenance.

generated traffic was derived from population figures by applying the average trip rates per person. The total annualized average daily traffic for the base year, 2011, is presented in Table 1. In the SEWH section's opening year in 2018, traffic generated due to reduced transport costs was assumed to be about 25% of the traffic in the without-project scenario. It was assumed that about 15% of the traffic on the alternate route would divert to the new road, which will shorten travel distances and time, based on the findings of origin and destination surveys. Traffic growth rates were applied to these base-year traffic demand estimates to derive future traffic demand. Traffic growth on roads is generally estimated on the basis of historical trends and the forecasts for economic and population growth. In the absence of established time series data on traffic volume on the road sections, the traffic growth forecast was based on data available on vehicle growth and real gross domestic product (GDP) growth. The demand elasticities thus derived were 1.8 for passenger traffic and 1.2 for freight traffic.<sup>3</sup> Based on the actual GDP growth during 2011–2013, and the government GDP growth target of 8% in the 11th five-year plan covering 2013–2018,<sup>4</sup> the average GDP growth rate during 2011–2015 was calculated at 8.6%. Tapered growth assumptions were used for later periods to reflect stabilization of economic activity and growth over time. Accordingly, the passenger and freight growth rates were calculated as 15% and 10%, respectively. Table 2 summarizes the traffic growth rates and the assumed GDP growth rates for the analysis period. The same traffic growth rates in Table 2 were also applied to forecast generated and diverted traffic.

**Table 1: Base-Year Traffic Volume for Southern East–West Highway subproject**

Section	Car	Minibus	Bus	Truck	Total
Nganglam to 15 km point	25	44	4	2	75
15 km point to Rishore	2	3	0	0	5
Rishore to Dewathang	9	15	1	69	94

Source: Asian Development Bank estimates.

**Table 2: Assumptions for Traffic Growth Rates per Year (%)**

Period	GDP growth rate	Passenger traffic	Freight traffic
2011–2015	8.6	15	10
2016–2020	6.7	12	8
2021–2025	5	9	8
2026–2030	3.3	6	6
2031–2035	2.8	5	5

GDP = gross domestic product

Source: Asian Development Bank estimates.

## (ii) Pasakha Access Road and Alay Land Custom Station Component

5. The border crossing at Phuentsholing is the busiest in Bhutan. It handled about 0.7 million tons of exports and 1.2 million tons of imports in FY2011, or about 44% of all of Bhutan's

<sup>3</sup> The elasticities of 1.8 for passenger traffic and 1.2 for freight traffic are those typically used in developing countries during the period when vehicle ownership begins to expand.

<sup>4</sup> Government of Bhutan. Gross National Happiness Commission. 2013. *Eleventh Five Year Plan Volume I: Main Document*. Thimphu.

imports and exports in that year.<sup>5</sup> Table 3 shows the estimated daily freight traffic through the crossing for 2013, based on traffic surveys.

**Table 3: Estimated Traffic at Phuentsholing City Border Crossing Point, 2013**

Roads	Light commercial vehicle	Two axle truck	Three axle truck	Multi-axle vehicle	Total
Total trucks per day	486	816	76	46	1,424

Source: Asian Development Bank estimates.

6. Projected growth rates for truck traffic through the Phuentsholing crossing were assumed to be the same as the projected rates of growth in regional trade. The latter were derived from historical regional trade growth, using customs data from the Department of Revenue and Customs of Bhutan and the Directorate General of Commercial Intelligence and Statistics of India. The annual growth in trade and therefore of truck traffic was estimated at 3.32% for 2013–2020 and at 1.68% for 2021–2036. The analysis did not incorporate an assumption of generated truck traffic. It also assumed that the traffic growth in the southwest of the country will be lower than that in the southeast, because Phuentsholing City in the southwest is a matured economic region, while the Nganglam and Dewathang areas in the relatively less developed southeastern region have a higher potential for economic growth.

7. All the cross-border traffic between Bhutan and India in the west currently passes through the Phuentsholing border crossing. The immigration and custom clearance stations, weighbridges, warehousing, and transshipment yards are scattered in different locations in Phuentsholing City. This makes cross-border logistics inefficient and costly and causes traffic congestion in the city. In addition, even if they have no other business in Phuentsholing, all vehicles coming from India must go through the city to complete the custom clearance processes before moving to such further destinations as the nearby Pasakha industrial estate. Trucks from India, which account for most of the traffic to the Pasakha estate, have no alternative after offloading goods to returning through Phuentsholing and its border crossing on the way home. The project will provide a direct access road between the Pasakha industrial estate and a point on the border with India at Alay where it will construct a new land custom station. Under a separate undertaking, another road is to be built on India's side of the border to connect India's highway network with the new Alay crossing and the Pasakha connection road. This will divert a portion of the traffic which now passes through the Phuentsholing crossing. This represents the traffic demand for the new Pasakha access road.

8. The traffic demand on the Pasakha access road was estimated using 2013 traffic survey data. This was done by calculating the portion of the overall heavy truck traffic through the Phuentsholing crossing (958 trucks per day) was moving to and from the Pasakha industrial area (258 trucks per day)—26.93%. Future traffic demand on the Pasakha access road was estimated by applying the growth rates described in para. 6 to this estimated 2013 traffic demand.

9. Traffic demand in Phuentsholing City, other than the traffic flow to and from India, is estimated using traffic in 2013 and applying the annual traffic growth rates described in para. 6.

<sup>5</sup> FY before a calendar year denotes the year in which the fiscal year ends, . e.g. FY2008 ends on 30 June 2008. The fiscal year of the government ends on 30 June.

### (iii) Phuentsholing Mini Dry Port and Bypass Road Component.

10. The mini dry port will have a custom clearance station, a weighbridge, a transshipment area, and warehousing and containerization facilities. The consolidation of facilities and streamlined customs procedures will reduce process times significantly. The proposed bypass road, which will connect between the new mini dry port and a national highway will allow freight trucks to move to and from destinations in the rest of Bhutan and in India without entering the center of Phuentsholing City. This will deliver significant savings in time and operational costs and considerably reduce traffic congestion in Phuentsholing.

11. The traffic demand for the bypass road has been estimated as the traffic moving through Phuentsholing border crossing in 2013, minus the traffic that is expected to be diverted to the new access road and border station that will serve the Pasakha industrial area. This amounts to 73.07% of the traffic that passed through the Phuentsholing crossing in 2013 (Table 4).

**Table 4: AADT for Pasakha access road and Phuentsholing bypass road, 2013**

Roads	Light commercial vehicle	Two axle truck	Three axle truck	Multiaxle vehicle
Pasakha access road	131	220	20	383
Phuentsholing Bypass road	355	596	56	1041
Total traffic	486	816	76	1424

Source: Asian Development Bank estimates.

## C. Economic Analysis

### a. Project Costs

12. The total project cost is estimated at \$53.45 million, comprising (i) \$37.05 million for the construction of the SEWH between Nganglam and Dewathang (ii) \$9.20 million for the construction of the mini dry port at Phuentsholing and the bypass road around the city center, and (iii) \$7.20 million for building the Pasakha access road and the Alay land custom station at the new border crossing point. The cost estimates, including those for consulting services and physical contingencies, are in January 2014 prices. Economic cost for land acquisition and resettlement were estimated as the lost production value of agricultural land for the duration of the project's economic life.

### b. Project Benefits

13. The benefits for all the project components are mainly vehicle operating cost (VOC) and travel time savings. Time savings from reduced traffic congestion were also added in the analysis for the Pasakha access road-Alay land customs station component, since it will divert a substantial number of heavy vehicles away from the city center of in Phuentsholing. Savings in the costs of maintaining the city's urban roads were also added. The mini dry port and Phuentsholing bypass road component includes added benefits arising from savings the new dry port will provide due to a reduction of idle time and in losses of perishable goods that current result from delays in cross-border transit.

14. VOC and time savings were calculated using the Highway Development and Management model. As an input, the driver wage of Nu54 per hour was used taking import

parity price, i.e., the wage of drivers from India. The value of time was calculated based on Bhutan's per capita GDP. The per capita GDP per employed person was worked out, and average hourly income was derived by assuming 2,000 hours of work per year. The value of non-work time was taken as 0.3 of the value of work time. The calculated values for work time and non-work time were Nu151 and Nu45, respectively.

15. **Nganglam–Dewathang section of Southern East–West Highway.** The majority of benefits to be delivered from this component arise from diverted traffic. The diversion is expected because the road improvement will provide a route that is 103 km shorter than the one currently used via Pemagatshel. The next highest contributors are local traffic and generated traffic.

16. **Pasakha access road and Alay land customs station component.** The benefits will mainly be (i) VOC savings (ii) travel time savings, and (iii) the time savings from a reduction of traffic congestion in Phuentsholing city center. The maintenance cost savings on the current urban roads have also been counted as a benefit.<sup>6</sup> Since road maintenance in the city has been undertaken in response to load damage from heavy axle trucks, the diversion of a good deal of this traffic to the Pasakha access road will deliver savings in road maintenance.

17. **Mini dry port and Phuentsholing bypass road component.** This component will deliver mainly VOC and time savings to the users of the mini dry port and the bypass road, as well as time savings for the remaining traffic in Phuentsholing city center from the reduction in congestion. The VOC and time savings have been further divided into (i) savings for users resulting from more direct access to a weighbridge in the new mini dry port, and (ii) a shorter travel distance and faster travel time for users of the bypass road when moving through the Phuentsholing area. With facilities consolidated in the mini dry port, customs and transshipment processes will be streamlined significantly. This will also deliver benefits in idle time savings and reduction in losses of perishable goods. The idle time savings mainly consist of driver time savings, which have been calculated using the hourly driver wage (Nu54) and savings in inventory costs.<sup>7</sup> Savings in inventory costs have been calculated by applying a daily interest rate on the value of imports and exports passing through the mini dry port for a number of storage days saved.<sup>8</sup> It was estimated that storage times could decline by up to 2.5 days in 2018, from 3.5 days in the without-project case and by up to 4.85 days from 6.00 days in the without-project case in 2030.<sup>9</sup> The transshipment sheds to be constructed in the mini dry port will avoid the loss of perishable goods especially during raining days. This loss was calculated by applying 1% to the value of imported perishable goods—assumed as 15% of imports—during the rainy days, which were taken to be 29.45 of the days in the year or 106 per year. While a value of 5% was used in the economic analysis for the Burimari and Benapole land ports in ADB's similar project in Bangladesh, the more conservative 1% figure used here took into

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<sup>6</sup> The savings in road maintenance costs are expected to result mainly from the diversion of heavy trucks to the Pasakha access road. Some savings may result from the completion of the mini dry port-Phuentsholing bypass road component, but all the savings were included in the Pasakha access road-Alay land customs station component to simplify analysis.

<sup>7</sup> This drivers' time saving is due to reduced waiting time for custom clearance and is additional to that included in the VOC saving calculation.

<sup>8</sup> The 12% daily interest rate was calculated as the average of lending interest rates in Bhutan (14.0%) and India (10.6%) in 2013, based on statistics. (ADB. 2013. *Key Indicators for Asia and the Pacific 2013, 44<sup>th</sup> Edition*. Manila.)

<sup>9</sup> Reductions in storage times for imports and exports are based on estimates of the results of the designed improvements in land customs clearance and transshipment processes.

account Bhutan's cooler climate and the likelihood that this would mean lower perishable goods losses under the without-project scenario.<sup>10</sup>

### c. Results of Economic Analysis and Sensitivity Analysis

18. The results of economic analysis and sensitivity analysis for the project components are in Table 5. All project components are economically viable, with individual base case economic internal rates of return (EIRRs) of 14.5%—15.8%. The overall project EIRR for the base case is 15.4%, and the net present value is Nu 689.07 million. Adverse scenarios were tested, including (ii) a 10% cost increase, (ii) a 10% reduction in benefits, and (iii) a 1-year delay in project completion. All project components were found to be economically under these scenarios, with EIRRs of more than 12%. The sensitivity testing found that the EIRRs for all the project components are more sensitive to changes in benefits than to changes to costs. Switching values are in Table 6. The worst-case scenario analyzed for three project components and the project overall combined the effects of a 10% project cost increase, a 10% reduction in benefits, and a 1-year delay in project completion. Under this scenario, the mini dry port and Phuentsholing bypass road component had an EIRR of 11.6% and the EIRR of the Pasakha access road-Alay land customs station component was 11.1%—both still close to the 12% hurdle rate. However, given the advanced stage of the project preparations for the Pasakha access road, for which detailed design and bidding documents have been completed, the risk of a cost increase and implementation delay in this subcomponent is low.

19. The project will likely have other economic benefits, such as reduced damage to agricultural products in transit (mainly citrus fruits); improvement of the urban environment in Phuentsholing City, which will result from reduced traffic congestion and the reduction in carbon emissions and noise and air pollution; and the benefits expected from the implementation of a pilot scheme for promoting eco-friendly transport. These have not been quantified in the analyses due to the unavailability of data. Thus, the results of the benefits analysis are considered conservative.

**Table 5: Results of Economic Analysis**

Scenarios	Nganglam-Dewathang Section of the South East-West Highway		Mini Dry Port and Phuentsholing Bypass Road		Pasakha Access Road and Alay Land Custom Station		Overall Project	
	EIRR (%)	NPV (Nu million)	EIRR (%)	NPV (Nu million)	EIRR (%)	NPV (Nu million)	EIRR (%)	NPV (Nu million)
Base case	15.8	485.46	14.9	103.43	14.5	100.18	15.4	689.07
Cost Increase by 10% (A)	14.5	346.27	13.7	65.24	13.6	66.83	14.0	446.03
Benefit are reduced by 10% (B)	14.4	296.77	13.3	43.77	13.14	45.15	13.9	377.13
Completion delays by 1 Year (C)	14.6	356.33	14.2	81.08	13.03	43.82	14.2	472.85
Combination of A, B and C	12.2	23.29	11.6	(14.54)	11.1	-38.93	11.7	-60.51

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

Source: Asian Development Bank.

<sup>10</sup> ADB. 2012. *Report and Recommendation of the President to the Board of Directors: Proposed Loan and Administration of Loan and Technical Assistance Grant to People's Republic of Bangladesh for South Asia Subregional Economic Cooperation Road Connectivity Project*. Manila.

**Table 6: Summary of Switching Values**  
(%)

Scenarios	Nganglam-Dewathang Section of the South East- West Highway	Mini Dry Port and Phuentsholing Bypass Road	Pasakha Access Road and Alay Land Custom Station
Cost Increase by 10%	33	27	29
Benefit are reduced by 10%	25	17.5	17.5

Source: Asian Development Bank.

#### D. Financial Sustainability

20. All project components are non-revenue generating in nature. Though the Phuentsholing mini dry port will generate certain revenues in the form of port entrance and cargo weighing fees, imposing tariffs high enough to recover the capital cost is not practical, given that trucks using the Phuentsholing crossing do not currently pay fees. Moreover, setting such a high level of tariffs would conflict with the government's intention to encourage more regional trade through the project. Under these circumstances, the financial analysis focused on the financial sustainability of the operation and maintenance (O&M) of the project assets.

21. **Phuentsholing mini dry port.** An assessment was made of whether the possible tariff structure could recover recurrent O&M costs in the first 20 years of the mini dry port's operations, beginning in the opening year of 2018. Recurrent O&M costs are expected to come from the maintenance cost (2% of the investment cost per annum), staff and office cost, and a management fee for a private sector operator (5% of revenues collected).<sup>11</sup> These costs were assumed to increase at an annual rate of inflation of 7.5%.

22. Revenues will be collected from truck entrance fees and weighing fees. Revenue is expected to rise with increases in truck traffic and in entrance and weighing fees, adjusted according to inflation. For the purpose of this analysis, it was assumed that tariff structure will be revised every 5 years. This assumption was considered reasonable since it would allow for 5-year performance-based maintenance contracts for the dry port. Applying a fee of about \$1.00 per truck for entry and \$0.50 per truck for weighing—the same rates applied at the Burimari land port in Bangladesh in 2013<sup>12</sup>—and considering inflation during 2013–2017 the starting tariffs applied in the opening year in 2018 became about \$1.30 for the entrance fee and of \$0.70 per truck for weighing. The results of the analysis indicate an annual net operating profit during the analysis period, as summarized in Table 9. Hence, with the appropriate revisions of the tariff level every 5 years, the project will be financially sustainable over the 20-year operating period.

23. **Other subprojects.** The incremental recurrent costs associated with the Nganglam–Dewathang section of the SEWH and the Pasakha access road were estimated to equate to about 3% of the Department of Roads' current operations and maintenance budget and 0.2% of the overall department budget on an annual basis. Recurrent costs associated with the Phuentsholing bypass road and Alay land custom station were projected to be 2% of the Phuentsholing municipal government's annual budget. Incremental recurrent costs for the municipal government are expected to be less than 2%, given the expected reduction in the maintenance costs of the city's existing urban roads as a result of the traffic diverted to the new

<sup>11</sup> The maintenance costs include the management administration costs, security costs, office costs, and costs of maintaining the facilities.

<sup>12</sup> Bangladesh Land Port Authority. 2014. *Tariff Schedule 2014*. Dhaka.

project roads. Given the Bhutan government's commitment to provide adequate funds for maintaining the roads to be built under the project and the actual budget provision during 2008–2013 under the 10th five-year plan, it is reasonable to project that the project will be financially sustainable.

**Table 9: Operating revenues and costs for Phuentsholing Mini Dry Port  
(Nu million)**

Year	Revenue	Costs	Net Profit
2018-2022	19.28	14.71	4.56
2023-2027	30.61	22.49	8.12
2028-2032	48.26	34.33	13.93
2033-2037	76.14	52.52	23.62

Source: Asian Development Bank estimates.