ECONOMIC AND FINANCIAL ANALYSIS

A.   Introduction

1.   Phuentsholing is the main border crossing point between Bhutan and India, with 74% of all Bhutanese exports and imports transiting through it.[1] The project outcome will be improved road connectivity and service delivery at the border crossings for the Samtse and Chukha districts. The outputs will be: (i) the construction of a 3.3-kilometer (km) highway between Phuentsholing and Chamkuna, which will complete the missing link of the Southern East–West Highway between Phuentsholing and Samtse; and (ii) the procurement and installation of trade equipment at the mini dry port (MDP) in Phuentsholing and land customs station (LCS) in Allay, to facilitate cross-border trade within the subregional area.

2.   To assess the project's economic viability, an economic analysis was undertaken for each output separately by calculating net economic costs and benefits in with- and without-project scenarios. The economic analysis was carried out in accordance with the Asian Development Bank (ADB) guidelines.[2] The economic analysis assumes that the MDP and LCS, currently under implementation in an ADB-financed project,[3] will be completed, and both are therefore considered to exist in the without-project case.

B.   Demand Analysis and Forecast

1.   Phuentsholing–Chamkuna Section of the Southern East–West Highway

3.   The construction of the Phuentsholing–Chamkuna section of the Southern East–West Highway will have a significant economic impact, as it will complete the missing link of this national highway between Phuentsholing and Samtse—the two economic centers of the southwestern part of Bhutan. Future traffic on the Phuentsholing–Chamkuna road will consist of (i) local traffic created in Phuentsholing; (ii) traffic diverted from the current alternative route via India, which is 20 km longer than the direct route between Phuentsholing and Samtse that the new road will provide; and (iii) generated traffic.

4.   Traffic volumes for locally generated traffic were derived from population figures (with the total population in the project area reaching a maximum of 17,300 by 2030), average daily trip rates per person derived from comparable studies and regional areas, and observed existing vehicle occupancies (Table 2).[4] Diverted traffic volumes were estimated at about 84% of the existing demand between Phuentsholing and Samtse—currently transiting through India via Birpara and Jaigaon—based on vehicle operating costs (VOCs) and travel time savings. Traffic generated due to reduced transport costs was assumed to be 20% of the traffic in the without-project scenario based on the extent of VOC savings.

5.   Growth forecasts for diverted traffic were based on real gross domestic product (GDP) growth, estimated at 8.4% during 2015–2020 by the International Monetary Fund, with tapered

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[1] Government of Bhutan, Ministry of Finance, Department of Revenue and Customs. 2015. *Bhutan Trade Statistics 2014.* Thimphu.
[2] ADB. 1997. *Guidelines for the Economic Analysis of Projects.* Manila.
[3] ADB. 2014. *Report and Recommendation of the President to the Board of Directors: Proposed Loan and Grant to the Kingdom of Bhutan for the South Asia Subregional Economic Cooperation Road Connectivity Project.* Manila.
[4] ADB. 2012–2013. TA 7650-REG. *Regional Transport Development in South Asia. Feasibility Study Report: Panitanki and Jaigaon 2012.* Manila.

growth assumptions over time.5 GDP elasticities of travel demand were estimated at 1.8 for passenger traffic and 1.2 for freight traffic, reflecting the high growth of travel demand in developing countries during periods of significant vehicle ownership expansion. For 2015–2020, the passenger growth rate was calculated as 15.1% and the freight growth rate as 10.1%. Table 1 summarizes the GDP and traffic growth rates for 2015–2050, and Table 2 presents the total annual average daily traffic for the base year and for selected future years.

Table 1: Annual Gross Domestic Product and Traffic Growth Rate
(%)

Period	GDP growth rate	Passenger traffic growth rate	Freight traffic growth rate
2015–2020	8.4	15.1	10.1
2020–2025	7.0	12.6	8.4
2025–2030	5.0	9.0	6.0
2030–2035	4.0	7.2	4.8
2035–2040	3.0	5.4	3.6
2040–2050	2.0	3.6	2.4

GDP = gross domestic product.
Source: Asian Development Bank estimates.

Table 2: Traffic Forecasts on Phuentsholing–Chamkuna Road

Year	Traffic by Vehicle Type (vehicles per day)					Total	Traffic by Source (vehicles per day)			Project Area Population	Trip rate per capita
	Motor-cycle	Car/ SUV	Bus/ Minibus	LCV	2+-Axle Truck		Local	Diverted	Gene rated		
2022	2,080	3,440	130	750	240	6,640	5,700	790	160	8,795	1.7
2030	4,460	7,270	170	1,330	150	13,540	11,610	1,610	320	17,300	2.0
2035	4,850	8,270	270	1,490	210	15,240	12,580	2,230	450	17,300	2.1
2040	5,230	9,280	370	1,650	260	16,960	13,540	2,840	570	17,300	2.3
2045	5,250	9,690	490	1,700	310	17,570	13,540	3,350	670	17,300	2.3
2050	5,260	10,19	580	1,760	350	18,290	13,540	3,960	790	17,300	2.3

LCV = light commercial vehicle, SUV = sport utility vehicle.
Source: Asian Development Bank estimates.

2. Phuentsholing Mini Dry Port and Allay Land Customs Station

6. The border crossing at Phuentsholing is the busiest in Bhutan and handled about 0.5 million tons of exports and 1.1 million tons of imports in 2014, equal to about 75% of all imports and 13% of exports in quantity, and 82% of imports and 70% of exports in value (footnote 1). Trade growth forecasts were based on International Monetary Fund forecasts of imports and exports for 2015–2020, with tapered growth assumptions from 2020 onwards (Table 3). Only the growth of imports has been used in the analysis, considering the substantial share of electricity in total exports.

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[5] International Monetary Fund. *World Economic Outlook Database* January 2016. http://www.imf.org/external/pubs/ft/ weo/2016/01/weodata (accessed 12 April 2016).

Table 3: Annual Trade Growth Rate Assumptions

(%)

Period	Growth Rate by Value		Growth Rate by Volume	
	Imports	Exports	Imports	Exports
2015–2020	3.8	13.0	3.0	10.4
2021–2025	3.0	3.0	2.0	2.0
2026–2050	1.5	1.5	1.5	1.5

Source: Asian Development Bank estimates.

7.   Current traffic crossing the border at Phuentsholing consists of local traffic (primarily light vehicles), transit traffic from Samtse via India, and international traffic (primarily trucks from India). Local and transit traffic growth forecasts were based on the traffic growth assumptions established for the Phuentsholing–Chamkuna road (Table 1), while the growth of international traffic was based on the trade growth forecasts (Table 3). Traffic counts and origin–destination surveys were conducted to obtain existing traffic levels and assess the impact of the MDP and LCS on traffic demand. The LCS will relieve the current main border crossing at Phuentsholing of about 31% of truck traffic and 4% of light vehicle traffic, while the MDP will divert the remaining 69% of truck traffic at Phuentsholing. Table 4 and Table 5 summarize the cargo and traffic forecasts at the MDP and LCS.

Table 4: Cargo Forecasts at Phuentsholing and Allay

(tons per day)

Year	Trade through Phuentsholing MDP			Trade through Allay LCS		
	Imports	Exports	Total	Imports	Exports	Total
2015	2,450	1,519	3,969	2,380	1,061	3,442
2025	3,136	2,750	5,886	3,047	1,922	4,968
2035	3,639	3,192	6,831	3,536	2,230	5,766
2045	4,224	3,704	7,928	4,103	2,588	6,692

Source: Asian Development Bank estimates.

Table 5: Traffic Forecasts at Phuentsholing and Allay

(vehicles per day)

Year	Traffic through Phuentsholing MDP			Through Allay LCS							
	2-axle truck	3+-axle truck	Total	Motor-cycle	Car /SUV	Minibus	Bus	LCV	2-axle truck	3+-axle truck	Total
2015	759	84	843	37	370	11	10	57	193	192	870
2025	1,171	127	1,299	136	1,354	42	35	139	298	296	2,30
2035	1,359	148	1,507	295	2,950	91	76	235	346	344	4,33
2045	1,577	172	1,749	459	4,579	142	118	316	401	400	6,41

LCS = land customs station, LCV = light commercial vehicle, MDP = mini dry port, SUV = sport utility vehicle.
Source: Asian Development Bank estimates.

C. Economic Analysis

1. Key Assumptions

8. The economic analysis uses the world price numeraire. Costs and benefits were expressed in real terms as of 1 April 2016. A discount rate of 12% was used to calculate the net present value, and all costs and benefits were discounted to 1 July 2016. An analysis period of 34 years was used for the road infrastructure (with 30 years of operation after completion of construction), and of 21 years for the trade facilitation equipment (with 20 years of operation after commissioning). Residual values at the end of the analysis period were calculated using a straight-line depreciation method based on the assets' economic life.

9. 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 standard conversion factor is relatively high due to Bhutan's low import duties and its free trade agreement with India. A shadow wage rate of 1.0 was applied as unskilled labor is in short supply in Bhutan and most unskilled workers at construction sites are temporary migrant workers from India.[6]

2. Project Costs

10. The cost of capital has been estimated with bills of quantities and unit costs. The base project cost is estimated at $22.8 million, comprising (i) $18.7 million for the construction of the 3.3 km road between Phuentsholing and Chamkuna, and (ii) $4.1 million for the procurement and installation of trade facilitation equipment at the MDP and LCS. The project cost includes the cost of environmental impact mitigation, construction supervision, physical contingencies, and project management, but excludes any price contingency and interest during construction. Physical contingencies were estimated at 5% of capital costs. In addition to the base project cost, $1.675 million was estimated for the detailed design of the Phuentsholing–Chamkuna road. Financial costs were converted to economic costs using the standard conversion factor of 0.98 for the construction of the road. The trade facilitation equipment is free of taxes and duties, and economic costs are equal to financial costs.

11. Maintenance costs of the Phuentsholing–Chamkuna road consist of costs related to routine annual maintenance, monsoon and slide damage restoration, and periodic maintenance performed every 5 years. Based on analysis of the road maintenance budget of the Ministry of Works and Human Settlement (MOWHS) for 2013–2018, the total annual maintenance was estimated at $11,370 per km, or 0.31% of capital costs.[7] However, considering the location of the project road along a riverbed, annual maintenance costs were conservatively revised to 1.0% of capital costs. The maintenance of the trade facilitation equipment is discussed in paras. 15 and 16.

3. Project Benefits

12. **Phuentsholing–Chamkuna road.** The primary benefits delivered by the road arise from VOC savings and travel time savings, as the road will provide a direct route from Samtse to

[6] The unemployment rate in Bhutan was 2.1% in 2012. Government of Bhutan, Ministry of Labour and Human Resources, Department of Employment. 2012. *Labour Force Survey Report, 2012.* Thimphu; ADB. 2013. *Bhutan: Critical Development Constraints.* Manila.
[7] Government of Bhutan, Gross National Happiness Commission. 2013. *Eleventh Five Year Plan Volume II, 2013–2018.* Thimphu.

Phuentsholing that is 20 km shorter than the current route through India. Although the reduction of cargo delay costs could be considered a potential source of benefits, the value of most freight was not significant when converted to an hourly cost and was not taken into account in this analysis. The economic benefit arising from generated traffic was calculated as half the benefit for an equal amount of normal traffic.

13.   The Highway Development and Management Model 4 (HDM-4) was used to calculate VOC in the with- and without-project scenarios for nine vehicle types based on road geometry; road conditions; pavement structure; and surveyed costs of tires, lubricants, maintenance, vehicles, and fuel. The economic cost of diesel and petrol was based on the market price of $0.69 and $0.87 per liter, respectively, from which service taxes of about 1% were deducted. Travel time savings were calculated based on travel speeds, distances, and value of time. Travel speeds and distances were obtained from surveys and design parameters. The value of time was calculated based on Bhutan's GDP per capita, converted to an hourly rate assuming 2,000 hours of work per year. As origin–destination surveys indicated that 50% of all trips are work-related, the value of time for all trips was assumed to be half of the hourly GDP per capita. The resulting value of time was calculated at Nu48.3 per hour in 2016, and was assumed to grow in line with the real GDP per capita growth.

14.   **Trade facilitation equipment.** The project will provide trade facilitation equipment at the MDP and LCS in the form of (i) a truck gantry X-ray scanner; (ii) a container lifter; and (iii) several smaller types of equipment, such as customs rummage kits, drug testing kits, safety protective wear, and CCTV systems. The economic analysis was primarily based on benefits of the truck scanner, which will provide savings in staffing related to the automation of customs process, and of the laden container lifter, which will provide truck, crew, and cargo time cost savings. In addition, the smaller types of equipment will deliver several safety, security, and fraud detection benefits which have not been quantified for the purpose of the economic evaluation, and the truck scanner will generate additional revenues accruing from improved customs inspections.

15.   The economic analysis of the truck scanner was conducted by comparing costs in the with- and without-project scenarios for the same level of outputs. The truck scanner allows the inspection of 20 trucks per hour, while physical inspection requires 5 to 6 hours per truck. Assuming that brief physical inspections can be undertaken in 4 hours per truck with two inspectors, 160 man-hours would be required to achieve the 1-hour performance of the truck scanner. Net benefits of the truck scanner were calculated by adding capital and installation costs of the truck scanner ($3 million), annual maintenance costs (5% of capital costs), staff costs (three employees per shift) and training costs (0.5% of capital costs), and comparing them to the costs of a physical inspection based on 160 man-hours per day, staff annual salary, and annual training costs (2% of annual salary).

16.   The economic analysis of the laden container lifter was conducted by comparing existing and projected costs in the with-project scenario. Currently, cranes required for the off-loading of containers have to be hired from Hasimara in India. Existing costs include crane rental costs of $15.10 per container. Project costs include (i) capital and installation costs of $400,000; (ii) annual maintenance costs of 5% of capital costs; (iii) annual non-labor operating costs of 3% of capital costs; (iv) labor costs based on 300 annual days of operation; and (v) overheads calculated as 10% of operation and maintenance (O&M) costs. A second container lifter was included in projections for 2033, as the capacity of the initial lifter (80 containers per day) would be reached.

4. Economic Evaluation Results

17. The results of economic analysis and sensitivity analysis for the project components are shown in Table 6. All project components are economically viable, with a base case economic internal rate of return (EIRR) of 17.0% for the Phuentsholing–Chamkuna road and 15.6% for the trade facilitation equipment. The overall project EIRR for the base case is 16.7% and the net present value is $10.75 million. Annual streams of costs and benefits are shown in Table 8.

18. Sensitivity analysis was carried out with respect to the following adverse changes in costs and benefits: (i) costs increased by 10%, (ii) benefits reduced by 10%, and (iii) costs increased by 10% and benefits reduced by 10%. In the case of scenario (iii) the EIRR of the road component is 15.1% and the EIRR of the trade facilitation and logistics component is 11.8%—close to the 12.0% threshold selected for the project. The project is therefore considered as economically viable. The sensitivity test found that the EIRRs for both project components are more sensitive to changes in benefits than to changes in costs, and that the trade facilitation and logistics component is more sensitive to changes in costs or benefits than the road component. Switching values are provided in Table 7.

Table 6: Results of Economic Analysis

Scenarios	Road		Trade equipment		Overall project	
	EIRR (%)	NPV ($ million)	EIRR (%)	NPV ($ million)	EIRR (%)	NPV ($ million)
1. Base case	16.9	9.51	15.6	1.11	16.7	10.62
2. Costs increased by 10%	16.0	8.26	13.7	0.57	15.7	8.83
3. Benefits reduced by 10%	15.9	7.31	13.5	0.46	15.6	7.77
4. Costs increased by 10% and benefits reduced by 10%	15.1	6.06	11.8	(0.08)	14.6	5.98

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

Table 7: Summary of Switching Values
(%)

Scenarios	Phuentsholing–Chamkuna Road	Trade Facilitation Equipment
Cost increase	75.9	20.6
Benefit reduction	(43.1)	(17.1)

( ) = negative.
Source: Asian Development Bank estimates.

Table 8: Annual Streams of Costs and Benefits
($'000)

| Year | Phuentsholing–Chamkuna Road | | | | | Trade Facilitation Equipment | | | | | Total |
| | Costs | | Benefits | | Net Benefits | Costs | | Benefits | | Net Benefits | Net Benefits |
	Capital Costs	O&M	Local Traffic	Diverted Traffic		Capital Costs	O&M	Truck Scanner	Container Lifter		
2017	1,642	0	0	0	(1,642)	0	0	0	0	0	(1,642)
2018	2,712	0	0	0	(2,712)	4,871	0	0	0	(4,871)	(7,583)
2019	5,168	0	0	0	(5,168)	0	245	741	175	670	(4,498)
2020	4,554	0	0	0	(4,554)	0	245	741	210	705	(3,849)
2021	3,326	0	0	0	(3,326)	0	245	741	223	718	(2,608)
2022	0	115	784	1,071	1,740	0	245	741	236	731	2,471
2023	0	115	932	1,230	2,046	0	245	741	250	745	2,791
2024	0	115	1,091	1,415	2,390	0	245	741	265	760	3,150
2025	0	115	1,262	1,631	2,779	0	245	741	281	776	3,555
2026	0	115	1,404	1,821	3,110	0	245	741	306	802	3,912
2027	0	115	1,553	2,036	3,474	0	245	741	334	829	4,303
2028	0	115	1,710	2,279	3,873	0	245	741	364	860	4,733
2029	0	115	1,874	2,554	4,313	0	245	741	397	893	5,205
2030	0	115	2,045	2,867	4,797	0	245	741	433	929	5,726
2031	0	115	2,119	3,161	5,165	0	245	741	472	968	6,133
2032	0	115	2,196	3,488	5,569	0	245	741	515	1,010	6,579
2033	0	115	2,274	3,852	6,011	400	245	741	562	657	6,668
2034	0	115	2,355	4,257	6,497	0	245	741	613	1,108	7,605
2035	0	115	2,439	4,708	7,032	0	245	741	668	1,163	8,195
2036	0	115	2,505	5,105	7,494	0	245	741	729	1,224	8,718
2037	0	115	2,572	5,536	7,993	0	245	741	795	1,290	9,282
2038	0	115	2,640	6,006	8,531	(300)	245	741	866	1,662	10,192
2039	0	115	2,710	6,517	9,111	0	65	0	945	880	9,991
2040	0	115	2,781	7,074	9,739	(320)	65	0	1,030	1,285	11,025
2041	0	115	2,790	7,514	10,189	0	0	0	0	0	10,189
2042	0	115	2,799	7,982	10,666	0	0	0	0	0	10,666
2043	0	115	2,808	8,478	11,171	0	0	0	0	0	11,171
2044	0	115	2,818	9,005	11,707	0	0	0	0	0	11,707
2045	0	115	2,827	9,564	12,276	0	0	0	0	0	12,276
2046	0	115	2,836	10,158	12,879	0	0	0	0	0	12,879
2047	0	115	2,846	10,788	13,519	0	0	0	0	0	13,519
2048	0	115	2,855	11,457	14,198	0	0	0	0	0	14,198
2049	0	115	2,865	12,168	14,918	0	0	0	0	0	14,918
2050	0	115	2,874	12,922	15,681	0	0	0	0	0	15,681
2051	(5,012)	115	2,884	13,723	21,503	0	0	0	0	0	21,503
EIRR					**17.0%**					**15.7%**	**16.7%**
NPV ($'000)					**9,513**					**1,106**	**10,619**

( ) = negative, EIRR = economic internal rate of return, NPV = net present value, O&M =operation and maintenance.
Source: Asian Development Bank estimates.

D.   Financial Sustainability

19.   **Phuentsholing–Chamkuna road.** Incremental recurrent costs associated with the Phuentsholing–Chamkuna road are estimated to amount to about 0.24% of the FY2016 maintenance budget of the MOWHS on an annual basis, under the conservative assumption that annual maintenance requirements of the road amount to 1.0% of capital costs. The allocation for the annual road maintenance budget of the MOWHS is Nu3,460.6 million for FY2016, which includes Nu281.1 million for routine maintenance and Nu3,118.6 million for periodic maintenance and improvements. Given the actual budget provision for road maintenance in FY2016, it is therefore reasonable to expect that funds will be available to meet the operation and maintenance (O&M) costs of the road.

20.   The budget of the MoWHS for routine maintenance has significantly increased from Nu126.8 million in FY2012 to Nu281.1 million in FY2016. However, the budget for periodic maintenance and improvements has substantially varied, with a minimum of Nu442.0 million in FY2015 and a maximum of Nu3,118.6 million in 2016. This may reflect a short-term response to immediate reconstruction requirements. As the country partnership strategy, 2014–2018 for Bhutan mentioned that "the risk of underinvestment in the maintenance of fixed assets for their full economic life is perennial in the transport sector",[8] the risk associated with the sustainability of O&M of the road has therefore been listed as medium in the risk assessment and risk management plan. It is proposed that further discussions are held with the MoWHS and the government to lobby for the allocation of sufficient budget for the O&M of the Phuentsholing–Chamkuna road.

21.   **Trade facilitation equipment.** Recurrent O&M costs of the truck scanner are estimated to be about 6.1% of capital costs, that of the container about 9.8%, and that of smaller trade equipment items to be 5.0%. The total annual costs required for the O&M of the trade facilitation equipment are estimated to amount to about Nu21.8 million in 2019, increasing to Nu38.2 million in 2038 in nominal terms, assuming that costs increase at the foreign inflation rate for the truck scanner and at the domestic inflation rate for other equipment items.

22.   The trade facilitation equipment is non-revenue earning, as cost recovery will not be directly sought from users. Instead, the equipment is expected to indirectly generate additional customs revenues through the truck gantry X-ray scanner, which will allow systematic inspections of trucks and cargo, and consequently increase declaration rates and reduce fraud and false declarations. Revenues could also be generated in the form of laden container stacker handling fees, but the restructuring of truck entrance fees, weighing fees, storage fees, or handling fees at the MDP and LCS has not been finalized, and handling fees were conservatively not taken into account. The incremental customs revenues generated through the truck scanner would be incremental tax revenues, accruing to the general revenues of the Government of Bhutan. O&M costs are estimated to amount to 41.1% of the expected additional customs revenues in 2019, decreasing to 32.4% in 2038. However, the Department of Revenue and Customs has no inherent authority to directly allocate part of such tax revenue for the O&M of project assets. To support the sustainability of the O&M of the trade facilitation equipment, it is therefore proposed that further discussions are held with the Department of Revenue and Customs and the government to lobby for the allocation of sufficient budget for the O&M of the trade facilitation equipment, which is revenue-earning for the government.

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[8] ADB. 2014. *Country Partnership Strategy: Bhutan, 2014-2018.* Manila.